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The Engineering and Mining Journal

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The Baghouse in Lead Smelting

The baghouse was introduced in the zinc industry many years ago, was later adopted successfully in connection with the smelting of galena in the ore hearth in Missouri, and was tried in silver-lead smelting in Colorado at a relatively early date. For reasons that need not be given here, the first attempts to adapt it to the conditions of Colorado were unsatisfactory, but in 1887 the new Globe works at Denver were thus equipped and gradually it became a standard part of the modern silver-lead smeltery. The full results achieved by its aid have, however, been shrouded in mystery, which was for the first time unveiled by Anton Eilers, in a paper presented at the eighth International Congress of Applied Chemistry, recently held in New York.

In the smelting of 1,666,857 tons of charge, containing 177,346 tons of lead, in 4⅔ years at the Murray plant of the A. S. & R. Co., the baghouse increased the lead extraction by 1.269%, besides saving a little copper, gold and silver, that might otherwise have been lost in smoke. The value of the metals gained, however, was only $6547 more than the direct operating cost, but after allowing 6% interest on the cost ($127,195) of the plant and 5% amortization (which is none too high), there was a loss of $58,746.

On account of the advisability of extracting the arsenic content of the fume, it had to be shipped to another plant. If there had been an arsenic department at Murray the cost would have been less and the net loss in operation would have been reduced to $24,101.

The blast furnaces at the Omaha plant in the year 1910-11 treated 74,112 tons of charge, from which the baghouses yielded 580 tons of fume, containing 230 tons of lead. In this case there was a net profit of $7684, reckoning 6% interest and 2½% amortization on the cost of the baghouses ($60,000). Here, the cost of smelting the fume was much less per ton than in the case of the Murray plant, and amortization is reckoned at only 2½% instead of 5%.

The A. S. & R. Co., in its Omaha plant, has made a specialty of the treatment of lead-copper matte, which once was attended by large metallurgical loss, especially of the lead. This was overcome by passing the converter smoke to a baghouse. In the treatment of 53,667 tons of charge there was saved in the baghouse 1551 tons of fume, containing 1325 tons of lead, at a profit of $98,712, after allowing 6% interest and 2½% amortization on the cost of the baghouse plant (about $42,000).

In the words of Mr. Eilers, these figures show that "taking the immediate financial outcome only, baghouses are not profitable in lead-smelting works which treat ores low in the precious metals and especially in lead. But there is another consideration to be taken into account when smelting works are, like Murray, located in the midst of farms and villages. This is the elimination of constant lawsuits, which are bound to be of frequent occurrence, when arsenious oxide and the sulphates of lead and other metals are permitted to drop down into the fields. It must be decided, therefore, in the case of each smelting plant, whether it is not good business to expend the money for a baghouse and for operating the same, though an immediate profit is not apparent."

When the lead content of the ore rises, the use of baghouses becomes more and more profitable, which no doubt is at the maximum in the works of the Mississippi Valley that treat high-grade galena. In these works the introduction of baghouses increased the extraction of lead from about 90% to upward of 98%. We wish that Mr. Eilers had added some figures from the Federal plant. However, we are duly grateful for the valuable data that he has given, which is the first im-

portant contribution that has been made from the practice of the A. S. & R. Co.

We recommend a study of his figures, not only by metallurgists, but also by our conservationist friends, who harp upon the woful waste of the smelters without any consideration of the dollars and cents of the respective cases.

The Purity of Metals

Elsewhere in our columns we present an abridgement of the complaints of Ernest A. Lewis with regard to the new American standard copper specifications. The first feature that strikes us in Mr. Lewis' complaints is that either he or the American refiners of copper are in grievous error as to what can be done with electrolytic copper. Mr. Lewis says that the very best recast electrolytic copper would only just pass the analytical test of 99.88% Cu. According to the American copper refiners, material is being poured almost daily from their wire-bar furnaces, which is not only 99.88% copper, but is occasionally 99.93 per cent.

In regard to his statement that in England the percentage of arsenic is usually specified to be from 0.35% to 0.6% of arsenic for arsenical copper, while the only American specification given for arsenical copper is the unnecessary conductivity test, it might be said that the above specification by the American Society for Testing Materials cannot prevent anyone specifying and obtaining copper carrying 0.6% arsenic for his special use. And indeed we know that certain American refineries recently have had to cater to just such a specification.

While we feel that a portion of Mr. Lewis' argument is based on impossibility of regularly producing copper carrying 99.88%, and is hence unsupported by facts, and that another portion is wrong, in that it fails to take any account of individual contracts, there is something to be said against over-purity of commercial metals.

A leading wire drawer recently complained to us that, although the specifications were calling for about 99.88% copper, yet the companies were consistently supplying material analyzing about 99.92%. He stated that the last two or three years had seen a gradual slowing down of practically all of his drawing machines, using the same dies and machinery, due to the increasing purity of electrolytic copper. At the old speeds, the wires now constantly broke. Recently he had special lots of bars cast at about 99.86 to 99.88%; using this more impure material he had been able to speed up his machines to the old limits, while the wire drawn from these bars would still pass the conductivity test of his customers. The result is that he is now attempting to get a constant supply of electrolytic wire bars that will carry between 99.86 and 99.90% Cu. As a matter of fact, this would be as favorable to the concerns from whom he is buying, as it would be to him, for the reason that any impurities (except gold and silver) which they can sell as copper is so much clear gain.

It has also been stated on good authority that certain troubles recently occurring in the shop of a large maker of lead pipe were found to be due to an over-purity of the lead, that faster and better work could be done with certain brands of lead that proved on analysis to be more impure, through minute quantities of copper, than that which had given trouble in the machine.

Consequently it seems to be the case that impurities in the nonferrous metals are not always the unmixed evils that many chemists and metallurgists have long been accustomed to regard them, and that the workers in the nonferrous metals and alloys must begin to recognize the beneficial influences of infinitesimal quantities of certain impurities, as the workers in iron and steel were long ago forced to do.

Convertible Bonds

The great success of investors in certain issues of convertible bonds made by mining companies during the last four or five years, is likely to make this form of financing a favorite one in the future. Possibly the opinion will come to be held that there is some particular magic about it.

The success of the Utah, Nevada, Miami and other convertible bonds was due, however, to the increase of real value experienced by those companies. In all cases the promoters were obliged to make repeated demands for capital, either because they had underestimated the requirements, or feared to ask for such huge sums all at once. Too many issues of stocks might not have been regarded favorably, wherefore the idea of convertible bonds in the last demand for money.

These bonds gave the holders a mortgage on the property, thus securing their money, and by their converting conditions gave them a speculative interest which might become very valuable. In fact it did become valuable in these cases, because continued developments showed that the resources of the mines were much greater than when the bonds were issued.

Attention is called in the steel trade to the fact that, notwithstanding the large increase in steel production this year, the supply of the manganese alloys used in steel making has been practically stationary. Combining production and imports there has been this year a small increase—about 7%—in ferromanganese, with a larger decrease in spiegeleisen; the two about balancing each other, when the respective manganese contents are considered. This condition fully explains the large increase in prices of ferromanganese. The contract price of the imported alloy, which was $36.50 per ton at the beginning of the present year, is now $61; while for spot lots which are needed as much as $70 or $71 is charged, and such supplies are hard to get.

The important effect of Indian prosperity on the demand for the precious metals is well known. The remarkable feature of the present year is that the Indian demand, which has been very large, has run rather to gold than silver. For the 10 months to Oct. 31 India has taken from London a total of £10,947,463 in gold, an unprecedented amount, while the total value of its silver purchases has been £8,950,500, or about £2,000,000 less than the gold. The silver takings have not fallen off, but are greater than for several years past. The approximate quantities represented by these values are 2,816,100 oz. gold, and 77,270,500 oz. of silver being, respectively, about 15 and 35% of the world's production. The important question is what effect the growing demand for gold may have on future takings of silver, and consequently on the future price. An important point is that the gold and silver taken by India is nearly all absorbed, little being exported.

By the Way

In a certain mining town in the West, a Lutheran preacher was trying to improve the local cemetery by putting a fence around it, and was requesting help from the individual miners. A "Cousin Jack," who was asked for a small donation, replied: "I wunt give ee bloomin' cent, cause taint needed." "Why is'nt a fence needed?" the preacher asked. "Cause they aint nobody in, what can get out, an nobody out what wants in."

To John Mabbs, agent of the Isle Royale mine, in the Lake Superior district, belongs the credit for having introduced the power drill to the mining world, says A. H. Meuche, in a recent publication of the Michigan Geological Survey. Mr. Mabbs induced Mr. Rand, who was manufacturing a heavy drill for tunnel work, to make a light and portable one for mine use. With some old engines at the mine he made a compressor and with cast-iron pipe conducted his compressed air underground.

The *South African Mining Journal* celebrated its 21st birthday, September, 1912, by issuing an elaborately illustrated number containing 466 pages, 10x14½ in. in size. The history of this journal and the history of South African mining are practically coeval, and in this number the attempt is made to present a good epitome of the growth of the Rand in mining, metallurgy, geology and finance. Congratulations are due the *South African Mining Journal* on its anniversary number, and we hope it will continue to have a long and prosperous career.

In discussing the new regrinding plant at Calumet & Hecla, a correspondent, in the JOURNAL of Nov. 2, 1912, stated that the company was building, in its own shop, the tube mills and other apparatus to be used in this plant. The inference from this item would be that the old-style tube mills were to be used. This is not a fact, however, as these have been superseded by the Hardinge conical pebble mills of which 64 will be placed in this new plant. A tube mill was used in the old plant for over a year in competition with the Hardinge mill, with the result that the Hardinge type was selected.

An experience in regard to the early use of steam power in the Lake Superior copper country is told by Graham Pope. When they brought in the boilers for the Albion Mining Co. in 1854, no canal had been cut at the Portage and the Entry was not navigable for large boats. When these boilers were brought into the Entry no lighters were to be had on which they could be placed, says A. H. Meuche, in a publication of the Michigan Geological Survey. "Finally, under the charge of J. B. Lyon, all the openings being plugged, the boilers were launched overboard. One of these came back at the steamer and knocked a big hole in her side, but fortunately above the water line. The boilers were well roped together, the domes being kept upright by means of heavy planks bolted across them. A large sail was hoisted and the boiler catamaran sailed into the river. A large Mackinac sailboat was then chartered to go ahead with a long cable, and the whole outfit sailed up Portage River and Portage Lake 15 miles to Houghton, where the boilers were pulled ashore by cattle power."

The Standard Oil Co., of New Jersey, from whose control 34 subsidiary companies were taken by the decree of the United States Supreme Court, has, within the year, paid $20 per share to its stockholders, and, counting the payments made by the subsidiaries of the old trust, the holders of Standard Oil stock have within this period received more than $52,000,000 in dividends. This is equivalent, says the *Times*, to more than 52% on the parent company's stock. The highest dividend ever paid by the trust before its dissolution was forced by the government's suit under the Sherman law was 48%. In the year immediately preceding dissolution the trust paid only 37 per cent. Several of the subsidiaries are yet to be heard from.

Mining in the anthracite region of Pennsylvania has acquired new thrills in these days when no one can walk over the surface with the assurance that he may not be engulfed at this next step. A few weeks ago we chronicled the disappearance of a part of a railway train in a mine cave. Last week the daily papers reported the hair-breadth escape of Wally Buronski, who had started from the No. 2 stope of the Natalie colliery at Shamokin with John Stenchock and three mules drawing 10 cars. Stenchock rode the leading mule, Buronski being on the third. The ground broke, hearing which Stenchock looked back and saw the 10 cars disappearing into the earth, with the last mule struggling to retain its footing. Buronski crawled over his animal's head and grabbed the traces of the second mule just as his own disappeared into the chasm.

Reference was made in the JOURNAL of Oct. 26 to the beginning of work on the Myron Stratton Home, provided for in the will of W. S. Stratton. Secretary William Lloyd writes us that an injustice has been done the board of trustees in our comments on the delay in inaugurating this work. Mr. Lloyd reports that it was found by the executors of the Stratton estate that the discoverer of the Independence mine had left a very diverse and complicated property, largely undeveloped. It consisted of real estate in Denver and Colorado Springs, a large part of which was practically unimproved; mining property in Cripple Creek that had been operated at a loss for months; the street-railway system of Colorado Springs, which he had been rebuilding regardless of expense, but was still unfinished; a disputed mortgage on the Brown Palace Hotel; miscellaneous stocks and bonds; and a small cash balance. The executors were immediately assailed with numerous claims and litigation; they had on the one hand the task of building up the estate and on the other that of defending it from all kinds of attacks. The real estate and mining property have been put on a remunerative basis; the street-railway system demonstrated as a paying investment; the Brown Palace Hotel litigation won and possession taken; other litigation has also been met and defeated, aggregating over $22,000,000, or approximately three times the value of the estate. In January, 1910, the Myron Stratton Home was incorporated. The Broadmoor property of about 2700 acres was purchased and a comprehensive plan of development outlined for an irrigation and agricultural operation, including a model village that should be "a home for all ages and sexes;" the latter comprises houses for girls, boys, infants and the aged, dormitories and central dining hall for the infirm aged, schools, hospital, library, museum, assembly hall, dairies, power plant, administration buildings, etc. The bulk of the estate was to be applied to this purpose.

"With a view to exposing fraud in the exploitation of worthless mining properties and to standardize mining practice, the Cave Men's Association of New York has been incorporated," says the *Sun*. The directors are: Herbert Hall, Walter F. Pyne, Milton S. Salisbury, William C. Schmidt, Jr., and Edward A. Rugen, of New York, and Otto N. Rugen, of Brooklyn. Such an association would fill a long-felt need for laymen, could they be induced to patronize it before making their surreptitious "plunges," from which they expect ultimately to surprise their friends with mountains of wealth. A case in point is that of Augustin Max, "the blind banker of Paris," who, on Nov. 15, gave himself up to the police of that city, confessing to having spent $2,000,000 of his clients' wealth in New Caledonia mines, which he is now convinced will never pay a profit. A "mining dostor" whom the people may consult is needed, but the people do not know to whom to apply—and if they did, it is not at all certain that they would make the application. People like to make mining investments surreptitiously; we know plenty of mining engineers whose lay relatives do not consult them until it is a "coroner's job." But returning to the Cave Men's Association, investigation discloses that it is not organized along the above lines; it is, in fact, a student society at the Columbia School of Mines, a new rival for the Senior Mining Society.

Electric Power for the Copper Country

HOUGHTON CORRESPONDENCE

While the construction of power plants having for their object the sale of electrical power to mining companies has been a recent and rapid development in the iron-mining districts of the Lake Superior country, no developments along this line have occurred in the Michigan copper country, until within the last few weeks. The only possible exception to this is the compressed-air plant at the Victoria mine at the south end of the coppr range. The enormous quantity of air that is compressed in this plant has frequently raised the question as to why some of it has not been converted into electric power and transmitted to the mines further north. Perhaps one reason that this has not been done is that this amount of power is not constant throughout the year but is dependent to a large degree upon the water conditions prevailing in the Ontonagon River. There has, however, been little question as to the market for electric power in the copper country. The tendency of the developments there is to use this form of power, even to the extent of purchasing it from the only commercial electric plant in the country, situated at Houghton. In some cases, a company operating several mines in a given vicinity, has maintained a central plant for such a group.

It is interesting to note, therefore, that a company has been organized to develop water power, to convert such power into electricity, and to transmit the latter some distance into the heart of the copper district. Through the activities of Walter S. Prickett, of Sidnaw, Mich., the Sturgeon River Land & Development Co., has been organized, under Michigan laws, with a capital stock of $500,000. Joseph Morge, of New York, is president; William P. Belden, of Ishpeming, vice-president, and William M. Blain, of New York, secretary and treasurer. The New York officers are connected with the General Utilities Corporation, of New York, an organization that has devoted considerable attention to the development of water powers in various parts of the country. The engineers employed on the project to date, are Viele, Blackwell & Buck, of 49 Wall St., New York.

The Sturgeon River is fed by a large watershed and the lands embraced in the undertaking are situated in both Baraga and Houghton Counties, Mich. The principal storage dam, it is said, will be in Baraga County, at a point about three miles north of Covington, a station on the Duluth, South Shore & Atlantic Ry. This dam, according to present designs, will form a lake about six miles long and one and one-half miles wide, and will have a depth of about 22 ft., when filled. The flow line of the lake will be at an elevation of 1247 ft. while the elevation of the top of the dam will be 1250 ft. The spillway will be 300 ft. long. The power house will be about four miles from the foot of the lake, on the northwest quarter of the southeast quarter of Sec. 10, T. 48 N., R. 35 W., the elevation of this point being 247 ft. below the top of the spillway at the upper storage dam. About three miles above the power house, water from the Perch River will be brought through a pipe line to the power house, connecting with the large pipe line from the upper dam. The plans also provide for a second development on Sec. 8, T. 59 N., R. 35 W., four miles further downstream. The distance that power will have to be transmitted from the lower location to Houghton is about 40 miles.

The lands secured by Mr. Prickett include a right-of-way, 100 ft. wide, from the power house to the towns of the copper country, and constitute about 25,000 acres, so it is said. The line is planned to run north and to pass through the properties of the Globe and Copper Range mines, on its way to Houghton. It is estimated that about 20,000 hp. can be generated in these plants, and that half of this will be supplied in the initial plant. The field for such power in the copper country is a large one, as it has been said that the total power requirements of the district are about 200,000 hp. This undertaking, construction on which is soon to start, will unquestionably have far-reaching effects throughout the district, not only as it relates to the mines, but as to other industrial development.

Potash Explorations in Nevada

The results of explorations for salines in Silver Peak Marsh, Nev., recently made by the U. S. Geological Survey have just been published. Silver Peak Marsh is a salt playa or dried-up lake, about 20 miles west of Goldfield and 25 miles southwest of Tonopah. The exploration was made to ascertain whether deposits of potash salts in commercial quantities lie within easy reach of the surface. No extensive beds of such salts were discovered, although the salts in certain samples of brine contain as much as 3.80% of K_2O. Drill holes were sunk at several points in the old lake bed by means of a small, portable drilling outfit, operated by a burro, the borings being carried to a depth of about 50 feet.

Practically the entire surface of the playa, 32 square miles, is covered with salt that averages in depth about one-quarter inch. The upper muds, averaging probably 10 ft. thick, contain not less than 2% of salt. It is estimated that not less than 15 square miles of the northeastern part contain a 10-ft. saline bed, of which at least 60% is salt. Salt is being produced on a small scale by Frank Porter, of Silver Peak, who states that about 150 tons have been bagged and sold in three years.

The New Chief Geologist

In Washington, Nov. 13, the Secretary of the Interior announced the appointment of David White as chief geologist of the U. S. Geological Survey, to succeed Waldemar Lindgren, who leaves Washington to become Rogers professor of geology and head of the Geological Department of the Massachusetts Institute of Technology.

Mr. White entered the Geological Survey in 1886, slightly in advance of his graduation from Cornell University. His first appointment was as assistant paleontologist, his study of the fossil plants having been begun in the university. He served as assistant to Prof. Lester F. Ward, who, for many years, was in charge of the paleontological work of the survey and under whose direction Mr. White specialized in the study of the fossil floras of the older geologic formations. He pursued the study of these floras for many years, contributing to the history of the deposition of the coal measures in several basins and making many correlations of formations and individual coal beds.

Mr. White has also, in an honorary capacity, had charge of the Paleozoic plant collection in the National Museum, of which he is now associate curator. Familiarity with coal-bearing formations of the Eastern coalfields, gained in the study of the fossils, and technical knowledge of coal, gathered in the course of investigations of their microscopic composition, and of the problems concerning the origin of coal, led to his choice as section chief, charged with the economic work of the survey in the Eastern coal, oil and gas fields. Mr. White is a member of several scientific societies, including the National Academy of Sciences, and is president of the Paleontological Society and vice-president of the Geological Society of America.

Dr. F. L. Ransome succeeds Mr. Lindgren as chief of the section of economic geology of metalliferous deposits; Mr. Lindgren retains his position as one of the geologists of the survey and it is likely that he will, in the intervals of his new duties at the Massachusetts Institute of Technology, have even greater opportunity to continue his work on Western mining districts than was possible in his position as chief geologist. He will probably take up for the survey next summer the study of the Homestake mine, South Dakota, and has in view also some reconnaissance work in southwestern Arizona.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

Is Mining Languishing?

In an editorial in the JOURNAL of Nov. 9, 1912, it is questioned, in view of the dividends paid by mining companies, whether the general mining interests are less. It seems to me that there is only one answer.

Any active mining man knows dozens of good mining men and engineers, men of experience, who have been forced into other lines of business for a livelihood. Of late years, it has been almost impossible to interest anyone in a prospect—it used to be easy, if one had something of merit. Formerly any honest, well known prospector could always get a grubstake—let him try it now—nothing doing. And there is no prospecting being done.

Stop and consider, each of you, of your own personal knowledge, how many new mines do you know, that are being developed? Ten years ago you knew dozens, now you may count them on your fingers, possibly of one hand. I doubt, very much, whether there have been lately many worthless holes in the ground being developed with the expectation of selling them; that day has gone by, it is only occasionally now that a sucker can be found, or a hole salted on one. Some one, that the buyer has confidence in, is now sent to examine.

The inauguration of the extensive sale of "wild cat" stocks at Cripple Creek, Colo., which a few years later reached its zenith in the boom days of Goldfield, Rhyolite, Bullfrog, Rawhide and all over Nevada, when several shares being sold on every rock, and piece of one, in the state, so demoralized the confidence of the general public, in mining, that it has not yet recovered. But we will probably always have the professional fake-stock seller with us, or at least until the world becomes more honest than this generation.

While there are many things that enter into the causes of less interest in mining, I believe that the conservation movement, in the establishment of so many forest reserves, and the arbitrary rulings and construction of our laws, by the Land Office, to be the principal ones. The prospector has learned from experience that it is not worth while for him to attempt to buck against the ranger, as he loses out in the long run, and he has quit.

Over at Highgrade, a new camp, in California, the ranger has made the miners pay a ground rent for erecting a cabin, and the firewood which the prospector uses while working his prospect, must be paid for. A recent ruling of the Land Office requires that, in order to made a valid location, one must not only have ore in place, but it must be pay ore, a commercial proposition, at grass roots.

How many of the dividend-paying mines, mentioned on p. 877, Nov. 9, 1912, were commercial propositions at the grass roots? We venture not 50%; we know that 25% of them were not. Then what is the inducement to prospect? Without the prospector in the hills, to discover new mines, where will the mining industry be in 10 to 15 years, when the present mines are worked out?

I, personally, know of a discovery of a 30-ft. vein of good coal, last August, within about 15 miles of the Copper River R.R., Alaska, that cannot even be located, since, owing to Pinchot's conservation press-bureau movement, all lands were withdrawn from entry. This alone, so near present transportation, would be worth millions, and would save the people of Alaska 500% on the cost of coal. Conservation has helped to drive 700,000 farmers to Canada, and is killing the mining industry, in my judgment.

G. L. SHELDON.

Ely, Nev., Nov. 15, 1912.

The Mexican Mill, Virginia City, Nev.

I note with interest the very good article of Mr. Symmes, describing the Mexican mill at Virginia City, in the JOURNAL of Oct. 12, 1912. In the synopsis at the head of the article, attention is directed to the impossibility of obtaining a clear overflow from the Dorr thickeners because of the gelatinous clay in the ore. One of the illustrations shows a Dorr thickener covered with what we in the Black Hills have always been accustomed to term "foam," but which the author explains is not foam because it contains above 40% solids.

Without being interested in quibbles over words, I will say that my experience has been that with ore containing clay or oxidized iron there is a great tendency for an accumulation on top in continuous-operating settlers of what starts out as a foam containing solids but becomes in time practically pure clay or slime, entirely dry on the surface; and the fact that this contains 40% solids does not seem to me any reason for saying that it is not foam.

In the matter of the overflow from the thickener I would infer that Mr. Symmes has the same experience we have had, and which most plants with which I am familiar have had in continuous work in cyanide solution, that is, it is necessary to hold back the foam and take an overflow from underneath it; also that it is necessary to clarify the solution before precipitating it. I know of only two out of a great number of settlers where they undertake to precipitate settled liquid without clarification, as even the minutest trace of solids accumulates in the press and so causes a poor precipitation.

While I think that a man thoroughly familiar with cyanide practice would not consider the reference in the synopsis any reflection on the thickener, the average man with but a casual acquaintance with the same might easily so interpret it.

J. V. N. DORR.

Denver, Col., Oct. 28, 1912.

The St. Helen's Mining District

I have just read H. V. Winchell's article on the Mt. St. Helen's mining district in the October *Bulletin* of the A. I. M. E., after seeing the abstract in the JOURNAL of Nov. 2, 1912. As I made a trip into this district in September for the purpose of making a preliminary examination of the property of the Mt. St. Helens Consolidated Mining Co., I should like to add a few of my observations to those of Mr. Winchell.

I found that the Sweden vein, near Spirit Lake, has been followed by a tunnel for 2300 ft., and by surface showings for 2000 ft. further. Though the main portion of the tunnel shows low-grade pyritic material, the vein appears better near the breast, disclosing two oreshoots consisting of quartz carrying copper and iron sulphides. One is 190 ft. long, averaging 2 ft. wide, carrying 4% copper, the other is 85 ft. long or possibly longer (not enough development work having been done to expose its full length), averaging 2½ ft. wide, carrying 6% to 7% copper. The breast of the tunnel is at the beginning of another shoot, and carries 4% copper across 4 ft. The copper ore is accompanied by 1 to 2 oz. of silver per ton with a few cents in gold.

These assays do not include a soft gouge streak of several inches width, carrying some secondary sulphides, but represent hard primary ore that was formed

prior to the extensive regional metamorphism to which this whole country has been subjected in early Tertiary times.

A well defined plane of movement with abundant gouge follows the vein the whole distance, and though evidently postmineral, yet it is somewhat of an indication of the continuity of the original vein. The ore exposed by the tunnel lies at a depth of approximately 400 to 500 ft. below the surface, and is as good, if not better, than the ore exposed in a small tunnel on the same vein, 350 ft. directly above the aforementioned oreshoots. Fifteen hundred feet further along the strike there is exposed in a creek bottom a fine quartz outcrop of this vein several feet wide.

On the Chicago group there is exposed by a short tunnel a quartz vein fully 6 to 8 ft. wide, of similar character to the Sweden, and what is believed to be the extension has been opened up 1500 ft. further on. Work on the Washington and Lilbia claims has shown similar copper-bearing veins.

One of the pioneers of this district reports that at the head of Norway and Grizzly Creeks there are numerous outcrops of veins, which have been exposed by the removal of the heavy covering of pumice. However, this part of the district lines at an elevation of about 6000 ft., and is rather inaccessible at present.

Over on the Green River Basin, about eight miles by trail from Spirit Lake, are the Polar Star, Index and several other groups. The Polar Star shows scattered stringers and bunches of pure chalcopyrite, and does not appear favorable. The Index is a body of sulphide ore of contact metamorphic type, alongside a porphyry intrusion into the granodiorite, and a body of ore 5x80 ft. in horizontal dimensions, averaging $20 in gold, has been exposed.

The whole district has been covered by a heavy layer of pumice, probably thrown out by Mt. St. Helens, a volcanic cone, in recent times, and the underlying rocks have been exposed only in a few steep cliffs, and in some of the creek bottoms. This has been and will be a serious hindrance, in the proper exploitation of the district. I have gone into these matters in some detail for the reason that there has been conflict between the timber interests and the mining interests regarding the value of the district.

On the whole, my conclusions are that although no large deposits have yet been discovered, still the facts are that: (1) One vein, showing occasional shoots of ore, has been proved to have considerable continuity; (2) that there are a number of other veins of similar character outcropping, whose continuity might also be proved if not hidden by the thick covering of pumice; and (3) that the amount of development work done so far is extremely small, makes me feel that the wholesale condemnation of the district is altogether unwarranted.

Irrespective of the merits of the Mt. St. Helen's mining district, Mr. Winchell, in his article, makes some broad geological generalizations, which do not seem to me to be entirely safe. Lack of a gossan hat is not always an unfavorable indication. The gossan of most contact metamorphic deposits is a decidedly unimportant feature. Also in regions of recent and heavy erosion, all traces of gossan are usually removed.

Extensive softening and decay of the wall rock below the oxidized zone, adjacent to extensive and important ore deposits, may be true of certain types, but there are many exceptions. Contact metamorphic ore deposits and those bordering on that type show none of these phenomena. Instances are as follows: San Pedro copper mine, New Mexico; Adelaide copper mine, Nevada; Shasta County copper mines, California; Lost Packer mine, Idaho; and many others, too numerous to mention.

Another point which Professor Winchell brings out is the fact that the presence of tourmaline is unfavorable. Tourmaline is often the result of regional or dynamic metamorphism and is one of the common minerals in the many famous pre-Cambrian quartz-pyrite gold deposits of the world. Its presence or absence does not seem to be any criterion of value.

THAYER LINDSLEY.

New York, Nov. 4, 1912.

Settling El Tigre Slimes

Mr. Jakin's letter on p. 872 of the JOURNAL for Nov. 9, 1912, offers a good starting point for remarks on the right use of experimental results in laying out a plant; and for some other remarks which have no special relation to his letter.

To assist in calculating the volumes of the settled slimes that he mentions, I assume a specific gravity of 3 for the total solid in each case; and take for granted that there was approximately clear water above the final settled products. In his first case, it required an average of 8.8 min. to produce one inch depth of clear water in the tank, and 9.6 min. in the oil can (the ordinary 5-gallon oil can being 14 in. deep). In the second case, the times were 17 min. in the tank, and 17.1 min. in the can. The difference in times for the tank and the can, in the first case, may be easily accounted for by the uncertainty as to my assumed specific gravity of the solid.

These calculations indicate that the laboratory results were reliable; but they were not used in the right way. Mr. Jakin's statement that they were not reliable, is a little surprising in view of the fact that Mr. Mishler's article of Oct. 5, 1912, lays special stress on the rate of settling, while the time naturally depends on the distance to be settled. The principle established is the rate; the factors of time and distance enter in applying the principle to the conditions and necessities of practice. Small-scale experiments are useful if planned and carried out with due regard to the conditions of the full-scale work. If good judgment is exercised in doing this, and in applying the results, the mill installations will be successful. Whatever else it may be, engineering is the application of clear thinking and sound judgment.

In connection with this subject of clear thinking, it needs to be emphasized that many comparisons that are made of machines and of processes are useless, and often positively misleading, because the experiments are not parallel: Different types of grinding machines, or of concentrating machines, are not infrequently compared on the basis of results with different ores in different mills, without regard to the preceding preparation, quantity of water or other essential conditions. Sometimes, when different types of apparatus are tested under parallel conditions, false conclusions are reached because the results are compared and analyzed by illogical methods. There has sometimes been misleading discussion as to the relative merits of reverberatory and blast furnaces for smelting, without recognizing that, *per se*, the two are not properly comparable, one being adapted to fine and the other to coarse material.

The ability to see the essential points in a problem, and to deal properly with them, comes from experience intelligently utilized. Not from experience alone, for that may justify the common remark—"I have been in the business 20 years, and I ought to know." The pity is that so many who ought to know do not know. However, the ambitious young man in any business must realize that experience is absolutely essential if he is to amount to anything. Without it no really adequate knowledge can be acquired; and only with it can there develop that sound judgment which enables one to usefully apply knowledge to specific conditions. The sooner any young man gets out of his system the notion that "a relative who is a heavy stockholder helps most," and appreciates that patient, cheerful and enthusiastic "sticking to it" is essential to results, the sooner he will become a real man and be of genuine use in the world. The difference between effective and ineffective experience is the difference between the man who stumbles along blindly and the one who goes with his eyes open, his head working intelligently and smoothly, his hands on the throttle and the lever and his heart right. The latter type learns to think clearly, judge wisely and do well.

C. D. DEMOND.

Anaconda, Mont., Nov. 13, 1912.

The Value of Surveying

By James Higginson

Mining claims are frequently inaccurately measured at first, and in event of a proposed consolidation, it is an important point to have everything resurveyed, so that all fractions can be taken up. A good surveyor is an insurance against law-suits.

A phase in the consolidation of mining properties that is not often discussed, but which is of considerable importance, is the work of checking the surveys of the claims taken over by the consolidation, tying in all adjoining claims, patented and unpatented; and taking up all unlocated ground within, say, 600 or 700 ft. of the apexes of the veins that are to be worked. While the following remarks may apply more particularly to the development of fissure veins under United States law, they can be of fairly general application.

Reasons for Consolidation

When veins are so situated that by reason of inaccessibility and climatic conditions, it is impossible to follow them down from the surface it is necessary to work through a tunnel. If the tunnel is to be a long one, it is frequently advisable to consolidate several claims In order to finance the consolidation and drive the tunnel, outside capital is freuently enlisted and plans, maps, etc., are placed before those whom it is desired to interest.

The maps showing the claims to be consolidated are usually taken from the Surveyor General's records, or what amounts to the same thing, from the records of one of the U. S. Deputy Surveyors of the district. The claims shown consist of a backbone of patented property surrounded by a mass of locations, some of which have been surveyed and some not, the whole forming a fairly compact group. The claims that have not been surveyed always show the legal length and width and to the uninitiated look just as good as the ones that have been surveyed, and it is only in the mind of one who has been "through the mill" that the perfection of the group arouses the suspicion that things are not what they seem.

There are, of course, fractions between some of the claims, these are to be expected and are not a source of danger if they are noted and taken up without undue delay, but they must be taken up even if they do not show any mineral deposit and thus seem not at all necessary to the consolidation. The unsurveyed claims are then properly surveyed and staked. It may then be thought that safety has been attained and no one can take up any ground valuable to the company. Nine times out of 10 this is correct, but the other time the lightning strikes and the damage done is often large.

Occasionally errors are made in surveying claims for patents; these errors are usually small, and so long as a claim is worked by itself they are unimportant, but when an error is once made and the claim is patented, this error is carried along and covered up when adjoining claims are patented and its significance is finally forgotten. To a surveyor the reasons for covering up errors need no explanation; to the uninitiated it may be sufficient to say that some years ago it took from one to two years to have corrections made in patented claims, and when, in order to patent a new claim, it was necessary to show errors in prior patents, the unfortunate surveyor who attempted to make the changes drew upon himself the dislike of everyone mixed up in the case, particularly that of the owner of the new claim, because of the long delay in getting it through the Surveyor General's office.

Rectification of Patents Difficult

At one time the department held that errors in prior patents could only be changed by the prior patentee giving up his patent and patenting all over again at his own expense. Sureyors are fairly reckless, but I never knew one that made such a suggestion to a prior patentee. I do not know what the present regulations are, but it is a thankless job to make corrections, and it is not undertaken without important reasons.

It thus happens that errors creep into patented claims, and may amount at times to 40 or 50 ft. in length or direction, thus the position of the claim as shown on the maps is not the same as on the ground, and under the law the latter position governs. In this way the following conditions may arise: The consolidation maps may show a continuous length of 4500 ft., or three claims on the vein. The middle one may, by an error in surveying, be 1550 ft., instead of 1500 ft., thus covering more than the law allows. This error would only be found out by either a resurvey of the claim, or should a parallel claim adjoining on the side line be laid out, and might go undiscovered for years.

The above may seem to be an exceptional case, but it actually occurred—fortunately it was discovered by the company engineer, who promptly took the steps necessary to protect the company. If it had been discovered by an outsider, and it lay unnoticed a long time, there would have been an excellent opportunity for the discoverer to cut off $750,000 worth of development and improvements from three-quarters of the mine.

Another interesting case was that of a claim that was supposed to be 1500 ft. long, and patented for that length, but as the stakes were set 1450 ft. was all that they covered. The official maps of the district showed the claim 1500 ft. long and butting up against the claims to the north and south. A consolidation of this claim and others surrounding it was decided upon, and the new company immediately employed a surveyor to run survey lines through the whole group, take up all fractions and in all possible ways make the group as law-suit-proof as possible.

In regard to the claim under consideration it was found that the north corners were standing and there was no fraction there. The discovery had been obliterated by the mine workings, and the south corners had been destroyed to make way for mine buildings, roads, etc. From all information that could be gathered, however, there was reason to believe that the claim as it had been surveyed had been only 1450 ft. long, in which case there was a 50 ft. fraction in the middle of the company's holdings. By reason, however, of all evidence of the discovery and of the south corners being missing, it was safe enough to see that the north corners were kept in their places. When some enterprising citizens located the supposed fraction and attempted to sell it to the company, they ran into a patent for 1500 ft. of ground from the north corners which were standing, and wisely saw the uselessness of their efforts. If the surveyor had done nothing else than find and keep in repair the standing corners of this claim, he would have saved the company more than they paid him altogether.

Following the Apex

The United States mining law which gives the owner of a vein apex the right to follow it downward indefinitely may be theoretically admirable, practically it is a delusion and a snare. It is extremely rare to find an apex showing through the whole of a 1500 ft. claim. More frequently it is found that the only place on a claim where the vein shows is at the discovery point, and in a consolidation the presumption is that the vein runs from one discovery to another in a comparatively straight line. Heavy slide rock or other overburden may make it tremendously expensive to follow the apex so that the first information that the apex may be approaching a side line, through either faulting or a swing, is usu-

ally obtained from the mine workings. If this information is acted on quickly and adjoining ground immediately taken up trouble is sometimes averted, as the company has the first information on which to act and if their surveys above and below ground are detailed and accurate they can go immediately to the point in danger, while anyone else would have to do a good deal of guessing to get to the right spot. The company also has on its side the presumption that it has left no valuable ground unlocated and a certain amount of proof must be forthcoming before anyone else will go to the expense of locating and indefinitely holding adjoining claims.

Precautions for Safety

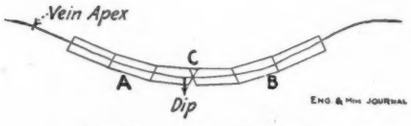
From several years experience in protecting consolidations and following their careers I think it is safe to say that the following procedure is well worth the cost. Immediately a consolidation is decided upon a competent surveyor should be employed, and by competent is meant not only that he can survey correctly, but he must have a good knowledge of mining law and also be thoroughly acquainted with Land Office rules. This surveyor should run meander lines through the group of claims tying in every corner standing.

It is not alone sufficient to tie to one corner of a claim and presume that the claim has been correctly surveyed, but every monument or bearing mark must be located; all adjoining and adjacent claims should be similarly tied in. The corners of nearby claims that have only been roughly staked by prospectors or others should have special care, as it is wonderful how these claims can swing about when their owners decide that they are not covering the ground where they will do the most good, or harm, and the only way that this change can be proved is to be able to show exactly where the original monuments were. While the surveying is going on all unlocated ground should be taken up, particularly any fractions large or small, that may exist between the claims of the group. This sounds like a lot of work; it is, and it costs a good deal of money, but any company that is so protected reduces the danger of a law suit by 90%, and all the work outlined above won't cost 10% of what a real lawsuit will.

Adjoining Claims

An interesting problem that comes up frequently in making a consolidation lawsuit-proof is the case of a prospector who has an adjoining or adjacent claim which he has staked without the aid of a surveyor, and which for various reasons may not have been included in the consolidation. These locations are almost invariably larger than the law allows, being anywhere from 1800 to 2000 ft. long and from 400 to 450 ft. wide where the legal width is 300 ft. The owner, of course, when he gets ready to survey can take up any part of this ground. As the prospector is seldom financially able to have his claim surveyed and as it is important to the company to know just what ground he intends to hold, I have usually found the following plan to work out to the best interests of both parties: First to place enough discovery stakes so that no matter what part of his 2000 by 400 ft. the prospector wants there will be no vacant ground left between his ground and that of the company, then see him and offer, if he will show what ground he wants, to survey it for him and give him a correct location certificate for record, at the same time explaining that the company wishes to patent the adjoining ground and has no desire to conflict with his rights, and that a correct survey of his ground is necessary to exclude it intelligently.

Should such an offer be refused by the prospector, the only thing for the company to do is to go ahead and start patent proceedings ignoring the owner of the claim entirely, then if he wants to hold his ground, he finds himself under the necessity, not only of having a survey made but also having to go to the expense of an adverse suit. I have known this to happen, but as a general rule just as soon as the prospectors find that the company will carry out its agreements to the letter they will accept such an offer and friendly relations will be established with adjoining owners. I have on occasion carried the agreement further and by giving him an agreement to deed the conflicting ground have patented this ground giving proper deed when receiver's receipt issued. This is often the better procedure, particularly if there is a probability of the ground becoming valuable, as when an unpatented claim is abandoned no one knows anything about it and anyone may restake it, but when a portion has been patented notice is always given through the tax sales that the portion has become delinquent, and if important it can be bought by the company.



An Unclaimed Fraction

Another interesting case in taking up ground occurs in the case of a vein of considerable continuity and with a dip of say 40° from the vertical. The apexes of these veins breaking over the ridges and down into the basins form curves, and often locations work toward one another from opposite directions, the result being as shown in the accompanying illustration. The two groups *A* and *B* come together at *C*. No part of the apex is left uncovered but there is at *C* a gradually widening wedge of the vein which belongs neither to *A* or *B*. I have seen cases where the angle at *C* was 25°.

Unowned Fractions May Prove Annoying

When deep mining is contemplated and a large capital necessary fair protection should be allowed, particularly when no one else is interfered with. In such cases it is not too much to take up 600 ft. of extra ground to cover the dip of the vein and 300 ft. of extra ground on the other side; no fractions however small should be left, they may appear useless to the company but are apt to be most annoying if they fall into other hands. It is safe to say that over 80% of the ground taken up is useless for mining purposes but under the present law it is absolutely necessary for protection.

Under present departmental rulings it is in cases impossible to find showings that will come up to the demands of the Land Office, and then the width above mentioned cannot be patented. It is a good thing to make the attempt, however, and if it fails the ground can be held by doing the annual assessment for which the ordinary mine development will count. The company has to be content with the assurance that if it can't get the ground no one else can.

With detailed and correct surface maps and all loose ground acquired not only is the danger of law suits reduced to a minimum, but the position of each and every part of the underground work can be located on surface in relation to every corner and line, and the danger of getting into foreign ground unknowingly is avoided. The management having ample warning that such a condition is likely to arise, if unable to acquire the ground can suspend work in that part of the mine until reasonable arrangements can be made to work it.

With adjoining claims in an inaccessible position and surrounded by company property, it is usually only when the company by trespass or otherwise puts itself at the mercy of an adjoining owner that it is difficult or impossible to come to a fair arrangement.

Temperature of Flames

According to a lecture delivered by J. A. Harker, at the Royal Institution, London, the accompanying table gives the temperatures obtained in various forms of commercial apparatus:

Working Temperatures	Deg. C.
Bunsen burner	1100—1350
Meker burner	1450—1500
Gasoline blast lamp	1500—1600
Large gas furnaces	1600—1800
Oxyhydrogen flame	about 2000
Oxyacetylene flame	about 2400
Thermit	about 2500
Electric arc	about 3500
Electric arc (under pressure)	about 3600
Sun	about 5500

Camp Bird, Ltd.

The directors of Camp Bird, Ltd., state that the profit for the 14 months ended June 30, 1912, were £287,326, while at that date it was estimated that the ore reserves at the Colorado property would yield a further profit of approximately £41,000. Since then more ore has been uncovered, which would apparently yield about £20,000 more profit.

There were 66,505 tons of dry ore treated, on which the extraction was 94.68%, yielding $26.15 per ton. The costs, exclusive of depreciation, were $7.81 per ton. In addition 98c. per ton was expended in 2920 ft. of development work.

As is known, Camp Bird, Ltd., owns £1,116,096 worth of shares in the Santa Gertrudis Co., Ltd. In addition it holds 574,830 shares of the total of the 3,000,000 one-dollar shares of the Imogene Basin Gold Mines Co., situated in the San Juan country, Colorado, and in the period under review has purchased shares in the Amistad y Concordia company, at a cost of £79,255. In addition, on Feb. 26, 1912, Camp Bird agreed to guarantee the interest for five years on an issue of £250,000 of 6% debenture stock of the Messina (Transvaal) Development Co., Ltd. In consideration of this guarantee Camp Bird received a commission of £2129 and an option until March 1, 1915, to subscribe for 125,000 Messina shares of five shilings each at 20s. per share.

It is with regret that we note the depleted ore reserves are now beginning to affect the working of the Camp Bird mill. Up to January 9, 1912, the production was kept at about normal, the entire 40 stamps running; from Jan. 10 to Apr. 28, 30 stamps; on Apr. 29, 15 stamps, and from Apr. 30 to June 30, 20 stamps.

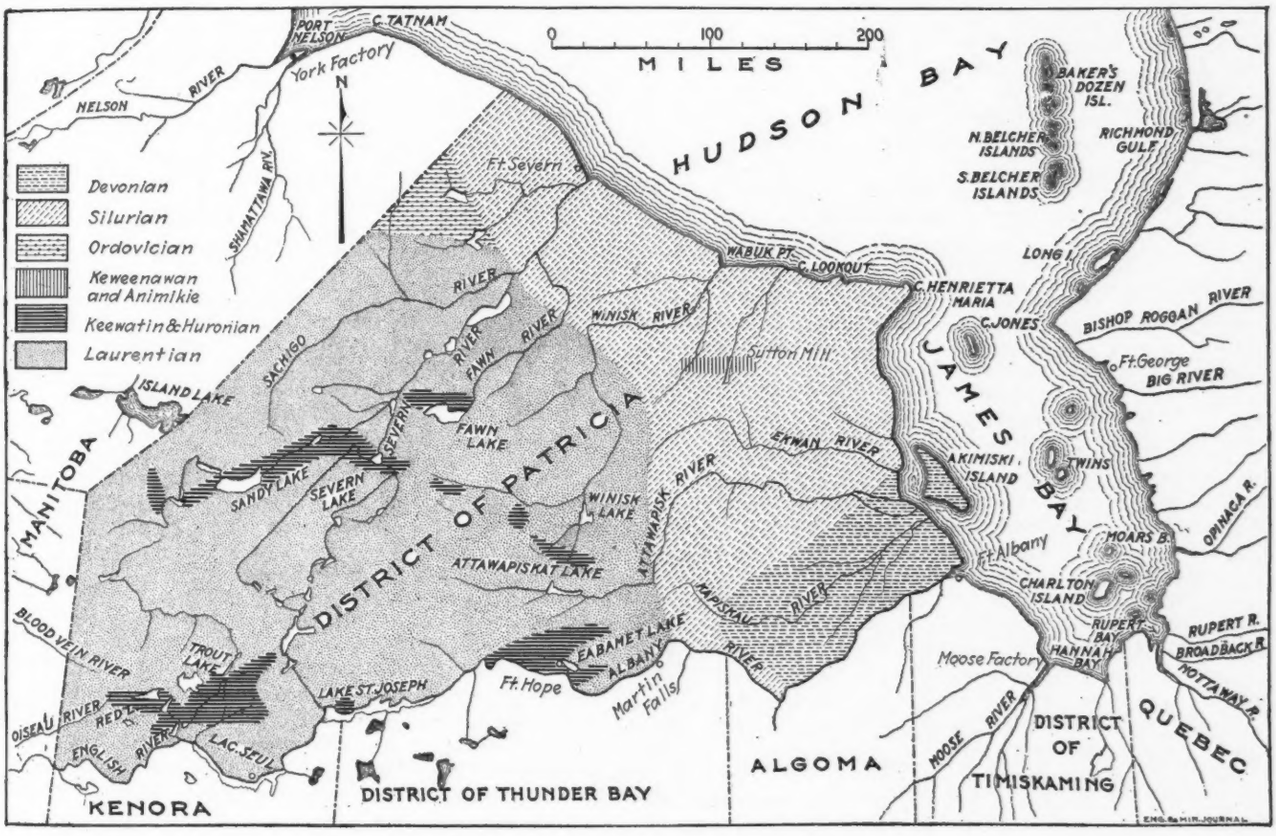
Patricia District, Ontario

The part of what was formerly known as the district of Keewatin, recently added to the Province of Ontario and renamed Patricia, comprises over 146,400 square miles, and adds over 56% to the area of the province. It is bounded on the west and northwest by the Province of Manitoba, on the south and southeast by the English and Albany Rivers, and on the east and north by James and Hudson Bays.

Explorations have been made in this district from time to time during the last 40 years by the Geological Survey of Canada, and much valuable information so obtained is scattered through the annual reports of the survey in a form inaccessible to the public. The data contained in these reports, together with some information obtained from other sources, has been compiled by Willet G. Miller, provincial geologist. This report embodies practically all that is known concerning the natural features of the district, and contains an introduction and summary of the contents by Doctor Miller.[1]

In elevation, the presence of numerous water courses and lakes and character of the rocks, Patricia differs but little from the older districts, and while the vegetation over a portion of the area is similar to that of the other sections of northern Ontario, there are certain differences in the more northern part. The greater part of the district is underlain by rocks of pre-Cambrian age, but along the coasts of James and Hudson Bays the rocks are of Paleozoic age. The accompanying geological sketch map, taken from the report, shows the distribution of the various series.

The exploration parties which have visited it have practically confined their attention to the water courses, but so far as can be judged from what is known of the geology, the district should contain important mineral deposits. The Keewatin rocks, which are found in considerable volume, should furnish deposits of gold, iron and other ores, such as occur in rocks of this age in other parts of northern Ontario. Limestones, similar to those of the Hastings and Grenville series of southeastern Ontario, are found



SKETCH MAP OF THE PATRICIA DISTRICT, ONTARIO

[1] Report of the Bureau of Mines, 1912, Vol. XXI, Part II.

at Red Lake and some other places. Just south of Nibinamik Lake, on a branch of the Winisk River, a mass of hypersthene gabbro, similar to the nickel-bearing intrusive of Sudbury, occurs in a belt of Keewatin rocks.

Rocks comparable to the Animikie, at the head of Lake Superior, or to the Nastapoka series of the east coast of Hudson Bay, are found at Sutton Mill Lake and outcropping through the Paleozoic on the Winisk River, 26 miles from its mouth. At the former place they are intruded and overlain by diabase, giving rise to conditions similar to those prevailing in the silver area at the head of Lake Superior and at Cobalt. The Animikie formation, at Sutton Mill Lake, contains iron ore in sufficient quantity to justify the hope that deposits of economic value may occur. The Paleozoic rocks extending inland from the coast of James and Hudson Bays are similar in age to those in the Erie-Huron peninsula of southern Ontario, and may, therefore, contain petroleum, natural gas, gypsum, salt and other valuable minerals.

Water in the California Oilfields

Discussing the danger from water in the California oil fields, W. H. Storms and Paul Prutzman draw the following conclusions (*Petroleum Review*, Nov. 2, 1912): Some competent authority must be set up to determine whether a dangerous condition really exists, and whether the extent of the danger justifies the probable cost of doing away with it. The first requirement is absolutely impartial advice from a competent engineer, commission, or association. The plan must provide either for a decision as to whether such work shall or shall not be done, by an official with arbitrary powers, or it must hold out a reasonable prospect of agreement in most cases among the parties at interest. Scattered and haphazard work will be of but slight and local value. A competent and permanent engineering staff must be provided for the supervision of work undertaken by individuals.

A State officer or a commission, is advised. The duties of this office would be:

(1) To determine accurately the extent and location of danger from water, and make a comprehensive report as a basis for further work; (2) to obtain, with or without the aid of an act of the legislature, the logs of the greatest possible number of wells in all fields affected, and to publish cross-sections and other data explaining underground conditions; (3) to trace, as far as possible, the responsibility for all occurrences of water in oil wells, and to distinguish between those subject to remedy and those that are beyond correction; (4) to analyze and determine the source of all waters, and all varieties of oil; (5) to formulate and publish plans for corrective work, and to urge those plans on individuals, local water associations and county supervisors, and where these plans are adopted ,to supervise the work as carried out, and direct it, as far as possible, into the most profitable channels; (6) to promote the formation of local water associations and assessment districts, and suggest such plans for these (in regard to organization) as seem most in keeping with local conditions; (7) to furnish detailed advice and instructions to individuals who wish to undertake correction work, but lack engineering skill.

Michigan Iron Ore Reserves

NEGAUNEE CORRESPONDENCE

The "Mineral Resources of Michigan" recently prepared by R. C. Allen, state geologist, contains a statement of the iron-ore reserves of the state as compared to those of Minnesota. As compiled by the State Tax Commission, the total reserves of Michigan are 196,354,883 gross tons with an assessed valuation of $93,933,629, or $0.473 per ton in the ground. The State Tax Commission of Minnesota estimates 1,347,596,291 gross tons, with an assessed valuation of $220,423,038, or $0.163 per ton. It is thus seen that Minnesota's reserves are about seven times the known reserves of Michigan, and are assessed at approximately two and one-half times the Michigan valuation.

However, it has been confidently predicted that Michigan will be steadily mining iron ore when the Mesaba is a barren waste, the reason being that the shallow resources of the latter range are blocked out "like a bag of flour," while the more complicated Michigan districts are but partially explored.

It is interesting to note that J. R. Finlay's appraisal of Michigan mines gave the average value of developed but unmined iron ore at $0.61 per ton, while the State Tax Commission values it at $0.473 per ton.

In regard to the proportion of ore reserves, on the different Michigan ranges, owned by the U. S. Steel Corporation, the accompanying table is given by the state geologist.

These figures, of course, apply to ore which is merchantable today, and not to the immense tonnages of lower grades that will some day become available. It is seen from the table that, contrary to the general belief, the U. S. Steel Corporation controls only about one-quarter of Michigan's ore reserves.

STEEL CORPORATION RESERVES IN MICHIGAN IRON MINES.

District	Total Reserves 1911 Gross Tons	Controlled by U. S. Steel Corporation Gross Tons	Per cent.	Controlled by Independent Companies Gross Tons	Per cent.
Gogebic	43,000,000	19,600,000	45.5	23,400,000	54.5
Iron River	42,122,000	1,400,000	3.3	40,722,000	96.7
Menominee (including Metropolitan, Calumet)	19,306,074	10,800,000	56	8,506,074	44.0
Marquette	77,126,651	21,616,335	28	55,510,316	72.0
Gwinn	6,746,158	266,000	3.9	6,480,158	96.1
Crystal Falls	8,054,000	625,000	7.7	7,429,000	92.3
Total	196,354,883	54,307,335	27.7	142,047,548	72.3

The yearly shipments of the U. S. Steel Corporation and the independent companies are about in proportion to reserves controlled, as regards the State of Michigan.

In 1909, the United States Steel Corporation shipped 24.08% of Michigan iron ore; in 1910, 25.07%. On the other hand, in Minnesota the Steel Corporation occupies a much greater relative position, so that, in 1909, of the total tonnage shipped from the Lake Superior region as a whole (including Minnesota, Michigan and Wisconsin) the Corporation shipped 51.4%, and in 1910, 51 per cent.

Smoke Troubles at Sudbury

SUDBURY CORRESPONDENCE

The smelter fume issue, which has not heretofore been raised in the Sudbury nickel district, is now appearing and the outcome will be watched with interest. A suit has been commenced by J. F. Black, of Sudbury, against the Canadian Copper Co., asking damages for alleged injury to the plaintiff's garden and conservatory, situated in the city limits of Sudbury, about three miles east of the Copper Cliff smeltery. The damage is ostensibly due to the fumes from the roast heaps, which, at certain seasons, settle over the country for miles around the plant, causing a distinctly sulphurous atmosphere, and, it is alleged, destroying certain vegetation. Heretofore the agricultural development of the region has been slight and the company itself is the fee owner of many thousand acres near the plant, so the issue has not been raised, although the fact of the fumes has at times been self-evident to all the residents. Prior to Mr. Black's suit, Major Leckie subscribed to a public protest against the alleged fume nuisance, and other suits are, it is claimed, in preparation awaiting the outcome of the Black test suit, which only asks for damages, while others, perhaps from hostile motives, are talking of an injunction to prevent the continuation of the roasting process in the immediate vicinity of Sudbury.

Both the Canadian Copper Co. and the Mond Nickel Co. resort to heap roasting, and the result, of course, is more or less sulphur fumes, as the ore contains from 27% to 35% of sulphur.

Details of Practical Mining

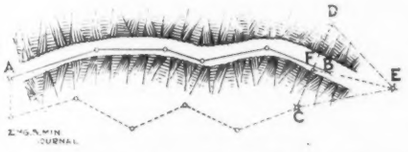
Accounts of Useful Ways of Doing Many Things in the Day's Work

Survey Method of Locating a Shaft

BY H. G. HENDERSON*

A mine surveyor is frequently called upon to make the surveys for sinking a shaft from the surface to a particular point required below, and in some cases a certain amount of difficulty is presented in deciding the best method to pursue. This is, of course, determined to a considerable extent by the local conditions. The following, however, will be found a suitable method:

In the diagram let the point *A* represent the mouth of an adit *A* to *B*, where *B* represents the end at which point it is desired to sink the shaft from the surface. The first step in the operation is to survey the adit itself from *A* to *B*, and in this way it will be possible to gain a fairly accurate idea of the point on the surface at which the proposed shaft will have to be sunk. When this point has been thus approximately fixed, the surveyor should proceed to the spot, and



METHOD OF SURVEYING FOR SHAFT LOCATION

around it he should place three pegs at positions such as those indicated by *C*, *D*, and *E*. It will then be necessary to take the triangle *CDE* as the starting point and survey back as illustrated by the dotted lines to the mouth of the adit, this survey being, of course, conducted on the surface. The work up to this point should then be carefully plotted in the office. The line *EB* should be produced to the point *F*, joining the points *CD* on the surface, and the distance *CF* and *FB* should then be measured by scale.

It is then an easy matter to proceed to the locality and to measure off on the surface these two distances, and it is evident from the diagram that when this is done the exact spot at which the sinking must be commenced will have been accurately determined. It is only necessary to add that in certain instances it may be found that this spot falls outside the triangle owing to the fact that the first approximation as described above was not sufficiently closely determined. When this happens the line *CF* and *FB* should be measured as before, the point *B* then falling outside the triangle, but as a practical rule it will be found to be considerably safer to work on interior lines as shown.

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Suspending a Diamond Drill in a Stope

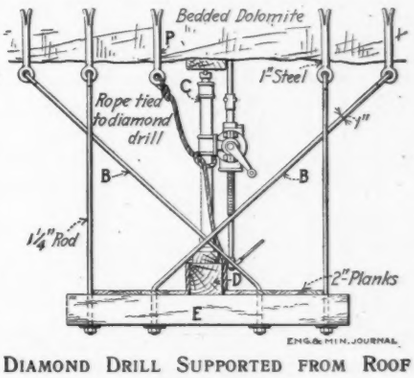
A method of hanging a diamond drill from the roof of a stope about 40-ft. high is shown in the accompanying drawing. A diamond drill was hung in this way at one of the mines of the St. Louis Smelting & Refining Co. in the southeastern Missouri lead district. A diamond-drill hole had been sunk from the surface and was being reamed out. The reamer stuck when about 10 ft. above the top of the stope. To recover the reamer it was necessary to rig up a drill and ream out the hole from below.

A light stage was put up similar to those used in the district in trimming down backs of high stopes after mining has progressed ahead and slabbing of the dolomite occurs. From this stage, which was about 34 ft. high, a hole was drilled a distance of about 18 in. so as to "bottom" in the second or third bed of dolomite above the roof. An eye-pin, split at the end and with an iron wedge fitted into the split, was put in the hole and driven in until the spreading of the split end by the wedge resulted in firmly anchoring the eye-pin in the hole. Three pieces of wood were wedged in around the pin at the collar of the hole to prevent any possibility of the eye-pin coming loose through side movement. A rope was tied in the eye of the pin and thence taken down to the top timbers of the stage so as to secure the stage to the roof. Then the other holes shown in the drawing were drilled and eye-pins put in as before, in a double row so as to fasten securely each end of the stage.

The main timbers of the stage were held by two vertical pins into which were fastened two swing bolts passing clear through the sill timbers. These were made of 1¼-in. iron. Then the side swing was taken care of by two rods *B* passing through the main timbers *E* on opposite sides of the blocking beam *D* and crossing just above it. On the beam *D* the column *C* of the diamond drill was set up and jacked tight.

The diamond drill was set up on this column directly under the hole that was to be enlarged, but before drilling began the rope from the main pin *P* was tied around the diamond drill and the column so that in case the pin came loose, the weight of the drill would be held by the pin *P*. On the sill timbers *E* a staging of 2-in. planks was laid. This was only an auxiliary stage, for the main stage from which the men worked was the top floor of the movable stage used to gain access to the roof when putting in the pin holes.

The reamer bit was recovered only an hour or so after the drill was set. As the original hole had come through into the stope, the whole problem was to rig the drill from the roof. A Western miner from another district would have hesitated before drilling the eye-pin hole



DIAMOND DRILL SUPPORTED FROM ROOF OF A STOPE

from the top of a staging 40 ft. high, the legs of which were only 2x6-in. planks. Fortunately the miners in southeastern Missouri are accustomed to rigging these stagings to stand upon, while barring down or drilling holes to blast loose slabs of rock from the back of high stopes. Nevertheless the idea of hanging a diamond drill from the roof of a stope 10 ft. high is ingenious.

Simple Method of Jacketing Trommels

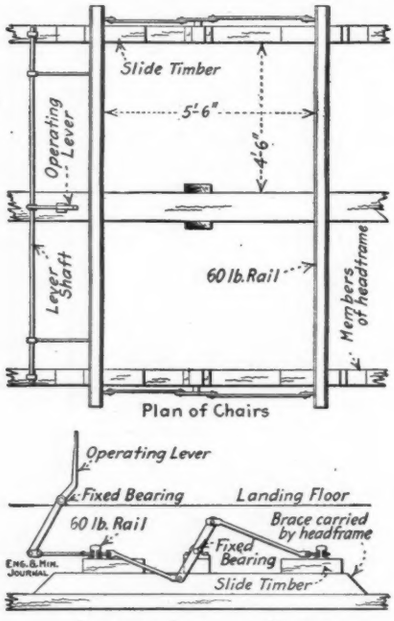
Often in changing the product of a revolving screen, or in reducing the amount of screen space so as to pass over more fine material, there is a delay caused by changing the screen plates or by putting on steel jacket plates.

A simple method of jacketing a portion of the screen is to wrap it with manila rope, says Benedict Shubert (*Coal Age*, Aug. 31, 1912). There is always a

large amount of old manila rope lying around every mine and this can be quickly wrapped around any portion of the screens so as to close as much, or as little, of the openings as may be desirable. The rope can be wrapped quickly by fastening the rope at one point and then starting and revolving the screen slowly, allowing the rope to wrap itself around the screen cloth.

Simple Landing Chairs

In the accompanying sketch are shown the general features of the design of the landing chairs used at the shaft of the Desloge Consolidated Lead Co. in the lead district in southeastern Missouri. The chair, which is simple, is of the sliding and not of the leg type. It is made to serve both compartments of the shaft. The landing bars are 60-lb. rails placed head up. These slide upon blocks carried by the beams of the headframe. From the first beam the motion is transmitted by means of connecting rod through a double-arm lever to the landing beam on the other side of the shaft which in this way is thrown in at the same time as the other, without the necessity of a second lever shaft extending clear across the shaft at the other side from the operating lever.



DESLOGE LANDING CHAIRS

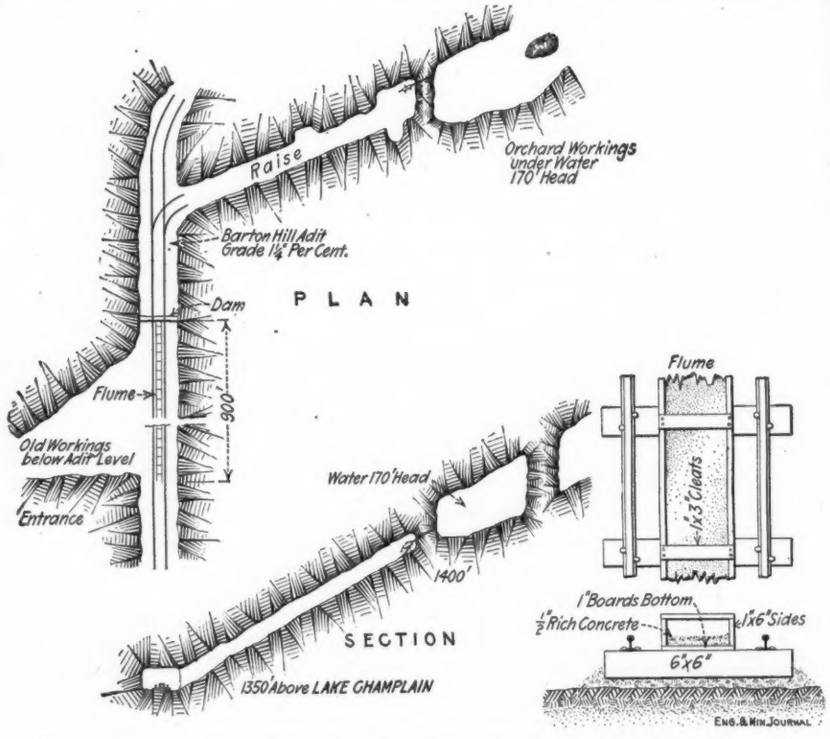
The operating lever is attached to the middle of the lever shaft so that it will be handy when landing either cage. Little handling of the two cages at the same time is ever necessary at the collar of a shaft, so there does not seem to be any special reason for not using a double chair at the surface. Of course, a double chair could not be used at intermediate shaft stations so safely, as it is often necessary to lower a cage past the one that is landed in the shaft.

Unwatering Old Workings

An adit (now 3500 ft. long), is being driven at Mineville, N. Y., into the magnetite deposits in Barton Hill. The ore left in the old workings, originally worked by inclined shafts, sunk on the outcrops near the summit of the hill, will be taken through the adit, but at present only the ore resulting from development drives is trammed and this is drawn in three-ton cars by an electric locomotive and stocked at the mill site.

To improve the ventilation and for development purposes, a raise, 140 ft., was recently driven from the main adit to unwater the old Orchard workings. When the surveyors showed the drive to be near the Orchard, the raise was widened, as shown in the accompanying drawing, and the machine was set up for the test hole. A wooden flume, 6x16 in. and 900 ft. long, lined with concrete, had been laid in the center of the tramroad on a 1¼% grade to carry the water beyond the lower old workings, which had been unwatered and were being developed below the adit level. A dam was built across the adit floor near the raise, to deliver the water into the wooden flume. The latter allowed tram cars to be run and was figured as being of sufficient cross-section to carry the entire volume of water across the lower workings, provided the test drill should stick when the drill holed. The machine was anchored to accomplish this. The flume proved to be satisfactory by carrying the full flow of water, permitting tramming, and being 75% cheaper than pipe of the necessary cross-sectional area. The 1x5-in. cleats, spaced three feet centers, strengthened the box and served as walking steps for the trammers. The bottom of the flume was covered evenly with ½ in. of tailings, and ½ in. of 1:3 concrete was troweled over this and rounded up a little higher on the sides of the flume.

While having no bearing upon the unwatering method, it may be interesting to know that the adit at 100 ft. penetrated the old "Lovers' Hole" workings, from which 50,000 tons of beautifully crystalline magnetite, analyzing 70% iron, was mined 20 years ago.



METHOD OF UNWATERING OLD WORKINGS AT MINEVILLE, N. Y.

Underground Survey Stations

The survey stations at the Baltic and Champion mines of the Lake Superior copper country are made of heavy wire nails about three inches long, which have a hole drilled in their heads just big enough to receive a match and hold it securely in an upright position. The surveyors drive these nails into the ties along the drifts, the top of the nail being flush with the top of the tie, and leave markers usually painted on the drift walls. In sighting a match is stuck in the hole and candles set one on each side of the match; no other illumination is required and a sharp, clear target is obtained. It is claimed that as instruments can be set up over the station instead of under it, much time is saved as compared with the usual type of roof station. Little trouble has been experienced due to movement of the ties.

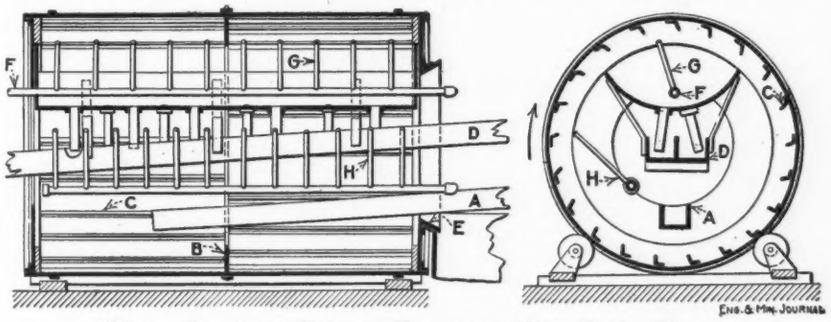
Details of Metallurgical Practice

Records of Experience in Ore Dressing, Cyaniding and Smelting

The Major Classifier

A classifier used at one of the mills in the Black Hills district of South Dakota operates on a principle rather different from that utilized by the majority of successful mechanical classifying devices. The machine referred to is known as the Major classifier and has been used in the Minnesota mill at Maitland, S. D., for 18 months, sufficient time to give it a thorough working test.

The classifier consists of a cylinder or drum mounted upon rollers so that it can be revolved, and having a bevel-gear arrangement for applying the power for rotation. The ends of the cylinder are partly closed, leaving openings varying in size with the requirements of the machine. The cylinder is divided in two portions by a ring, the height of which is somewhat less than the height of the end walls of the cylinder. Inside the cylinder are longitudinal ribs or blades fastened to the drum, these blades forming pockets or gutters with the cylinder shell.



MAJOR CLASSIFIER USED AT MINNESOTA MILL, BLACK HILLS

The operation of the machine is as follows: The pulp is introduced into the drum, revolving at from 1½ to 2 r.p.m., by means of a launder which enters through the overflow end of the cylinder and delivers the pulp at the opposite end of the drum. The launder is shown at *A*, Fig. 1, and at *B* is shown the ring which divides the interior into two parts. The blades, shown more clearly at *C*, Fig. 2, tend to agitate the pulp, and the lighter portion is overflowed past the dividing ring into the second compartment; the coarse sand settling in the pockets of the blades is elevated as the drum revolves and discharged with the assistance of a water or solution spray into a launder conveniently placed to receive it. This launder is shown at *D*, as are also the pipe and spray connections, *F* and G, for dislodging the coarse sand elevated in the pockets.

The portion of pulp which overflows into the second compartment repeats the same process exactly, except that the material is finer, and there may be a different arrangement of the blades or ribs with the object of taking out a product finer than that extracted by the primary compartment and leaving a pure slime product to be overflowed from the machine at the rear point *E*, this wall being lower than the wall partially closing the opposite end of the machine.

As the sand and middling are carried upward by the blades in their respective compartments, they are washed by a spray *H*, after which the discharging spray washes the material off into the proper launder or tray. In order that there may be two distinct products kept separate, the discharging launder is usually divided into two parts, or made as two launders running side by side, arrangement being made to dump each class into its particular launder. These launders may be arranged to discharge in different directions if it is so desired, but it has been found better practice to have them discharge at the same end, the one opposite to that through which the pulp enters. The drawings show the arrangement and operation of the machine.

The particular advantages obtained by the use of the machine are a saving of almost the entire fall, as the machine acts as an elevator as well as a classifier, and it occupies less floor space than the usual mechanical devices used for the purpose. The power consumed is small and the machine has a large capacity. A machine six feet in diameter and 7½ ft. long, when handling 30-mesh and finer solids at a ratio of one of solids to seven or eight of liquid, has a capacity of about 150 tons of solids per 24 hours.

Three products can be obtained, a coarse sand for regrinding, a finer sand, or middling, for leaching, and a slime for agitating, or any other convenient utilization of these products. If it were considered desirable, the machine could be easily developed to deliver additional products as required. No attention is necessary, as the machine works efficiently with varying feeds up to its maximum capacity. In case of a forced stoppage of the mill, the machine does not choke up and can be easily started even if filled with pulp.

The machine installed at the Minnesota mill is 6½ ft. in diameter and eight feet long and handled over 200 tons of solids per day with ease. Its cost is low and maintenance is slight. It was designed by Edmund Major, superintendent of the Minnesota mill, and has been patented in the United States, Canada and Mexico.

Joplin Types of Bucket Elevators

Two types of bucket elevators are in general use throughout the mills of the Joplin district. These are known as the mill or "dirt," and tailing elevators. The former are built inside the mill, are of low lift, 28 to 30 ft., and are required to raise the pulp from one piece of apparatus to another through which the pulp must pass in the process of concentration, because it is the practice in the district to place all mill apparatus, excepting screens and trommels, on the floor. The tailing elevators are often built outside the mill and are sometimes 60 or 80 ft. high in order that a high dump may be built up, and at some of the mills, especially those at mines of unusually long life for that district, a dummy elevator rope driven from the first elevator is used to elevate still further the discharge from the tailing elevator. Both types of elevator are driven slowly, and in order that the wet material may discharge cleanly the mill elevators are built at a pitch of 1:6, while for tailing elevators a pitch of 1:8 or 1:9 is common.

A satisfactory construction of elevator for raising wet material has been evolved in the district, but it may be said that in general the pulleys used are

too small. The smaller the pulleys the greater the difference between the strains on the two sides of the belt. In order to secure longer service, belts of more than the usual number of plies for elevator belts are used. It would seem to be preferable to use thinner belts made with fewer plies but of greater tensile strength because with thick belts crinkling of the inner face occurs on which the wear appears to concentrate. When the belts begin to wear dirt and water enter the holes, causing blistering of the belt and enlargement of the holes, especially when passing over the pulleys. Some millmen are now beginning to use woven belts of the balata and Scandinavian types.

The tailing-elevator buckets are from 16 to 24 in. wide, 18- or 20-in. buckets usually being used; the mill elevator buckets are 18 to 24 in. wide because they raise so much material for regrinding. The buckets are made locally of No. 10 or No. 12 sheet steel riveted together; No. 8 steel is sometimes used. It is the practice to rivet a center partition in buckets that are more than 18 in. wide as this partition reinforces the bucket and tends to prevent bending of the lip.

The tailing elevators are gear driven; the mill elevators are driven directly by belts. The elevator pulleys are from 18 to 36 in. diameter, the smaller sizes being more common. A belt speed of 325 to 400 ft. per min. for elevators driven by a small pulley is usual, but in the best practice the speed is 260 to 300 ft. per minute.

The elevator housings are always made with a sloping front and vertical back, so that all slippage may fall unimpeded to the boot. In order to give access to all parts of the elevators when it is necessary to make repairs, the housing is built so that there is 15 in. clearance on each side of the belt. The front of the housing at the mill floor is removable and is held in place by buttons, so also is the front section of the hood, the top of which is removable, and, as shown in the accompanying illustration, a ladder is provided at the side of the high tailing elevators. Below the floor line the front of the housing is generally made 12 to 18 in. wider than above and a ladder is put in to afford access to the boot. The clearance between the belt and the front of the housing is 12 in. At the top the housing is contracted six inches on each side.

A concrete boot is used in some mills, but it is the usual practice to use a simple box 12 in. deep. The feed box is put in front of the well and about 12 in. above the point where the buckets take the feed. The catch box at the top of the elevator is placed low so that the dump board can be put in under the overhang of the bucket and still allow two inches clearance between the lip of the bucket and the dump board. Then no matter how slowly the belt moves, the spillage at the top will run into the catch box and not fall into the housing. The top of the dump board is capped with a piece of pipe, which is quickly worn through by the tailing which then packs in the trough formed by the remnant of the pipe, making a bed of tailing to protect the edge of the dump board from wear.

The shaft of the lower pulley is carried in grooves cut in the ends of two pieces of 6x6-in. timber, which slide in guides nailed to each side of the elevator housing. These sliding timbers can be depressed to tighten the belt by levers. The levers are then held in place by pins. In some mills the double lever is used, in others the single lever, described in the JOURNAL of Jan. 21, 1911. A bolt is often used to close the forked end of these sliding timbers, so that the lower pulley will not drop out should the belt break. The housing of the elevators is generally made 10-in. wider on each side below the floor line, and the take-up device is placed below and inside the housing, so that the overhang protects it from wear from the spillage falling into the boot.

The frame of the housing of the tailing elevators and some of the larger mill elevators is made of 6x8-in. main timbers. The boxing of 1x12-in. boards is nailed to the inside of the main timbers, 2x6-in. timbers being used in the corners to make box joints. Putting the lining inside the frame prevents wear of the frame by the slippage and also prevents the main timbers from becoming waterlogged and warping out of shape upon drying when the mill is shut down. In building the smaller mill elevators, 2x6-in. planks nailed into a box corner are used as the main frame timbers for the housing. In the tailing elevators 2x6-in. diagonal braces are used to gain greater stability and often a brace is carried back to the frame of the mill building. The highest of these elevators are steadied by $\frac{3}{16}$-in. guy wires or old hoisting cables.

The bearings of the lower elevator pulley are not lubricated, as they generally turn in the water that accumulates in the boot. The upper pulleys of some of the mill elevators are equipped with large grease cups, but in others the bearings are so inaccessible that they get little lubrication. Hot boxes in the mill elevators have been known to start fires that caused loss of the entire mill.

Shafting and Belting Calculations

The accompanying charts represent a simple graphical solution of the problems which arise concerning shafting and belting. While presenting nothing new in theory, the application will be found useful, says Miles Sampson (*Power*, Oct. 8, 1912).

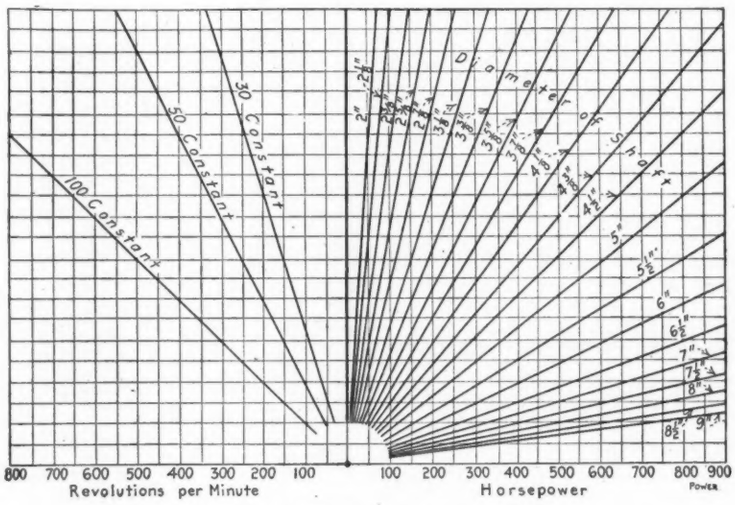


FIG. 1. CHART FOR CALCULATING SHAFTING

The chart for shafting is based upon the commonly used formula for the strength of shafting:

$$Horsepower = \frac{(diameter\ of\ shaft)^3 \times r.p.m.}{constant}$$

In explanation of the constant, it may be noted that 100 is used for head-ends of shafts receiving large amounts of power. By largely increasing the size of shaft necessary to carry a given power, it takes account of the large transverse stress due to the belt pull, and of the necessary stiffness. Any shaft carrying pulleys with belts over 6 to 8 in. wide should be figured using this constant. The constant 50 should be used to calculate countershafts driving ordinary machinery, and shafting carrying small belts. When 30 is used only the transmission of power should be expected of the shaft, no transverse stresses being considered.

The method of using the chart follows: On the scale representing the given speed

follow vertically to the line denoting the proper constant, then across horizontally to the line representing the shafting size. The abscissa of this point on the horsepower scale gives the allowable load. Thus, at 300 r.p.m. a 3⅛-in. shaft carrying small belting (constant 50) would transmit 180 hp. Problems having different given conditions may be solved in a similar manner. For example—to carry 400 hp. at 400 r.p.m. a head-end shaft must be 4½ in. diameter.

The chart for belting is based upon a speed for double belts of 600 ft. per min. per horsepower per inch of width. This is conservative in the light of present practice, but represents a standard toward which belt users are tending. For wide belts it may doubtless be decreased to 500 ft. per min. with perfect safety. For single belts the 600 becomes 1200, and for triple belts, 400.

For using the chart at any number of revolutions per minute follow vertically to the line representing the pulley diameter, which gives, on the vertical scale, the belt speed in feet per minute. Follow across horizontally to the belt width and down to the required horsepower. Thus at 400 r.p.m. on a 36-in. pulley (3770 ft. per min.) a 20-in. double belt will transmit 126 hp. Similarly, if a 30-in. belt is the maximum width available for transmitting 250 hp., a belt speed of 5000 ft. per min. is necessary; this requires a 60-in. pulley running 320 revolutions per minute.

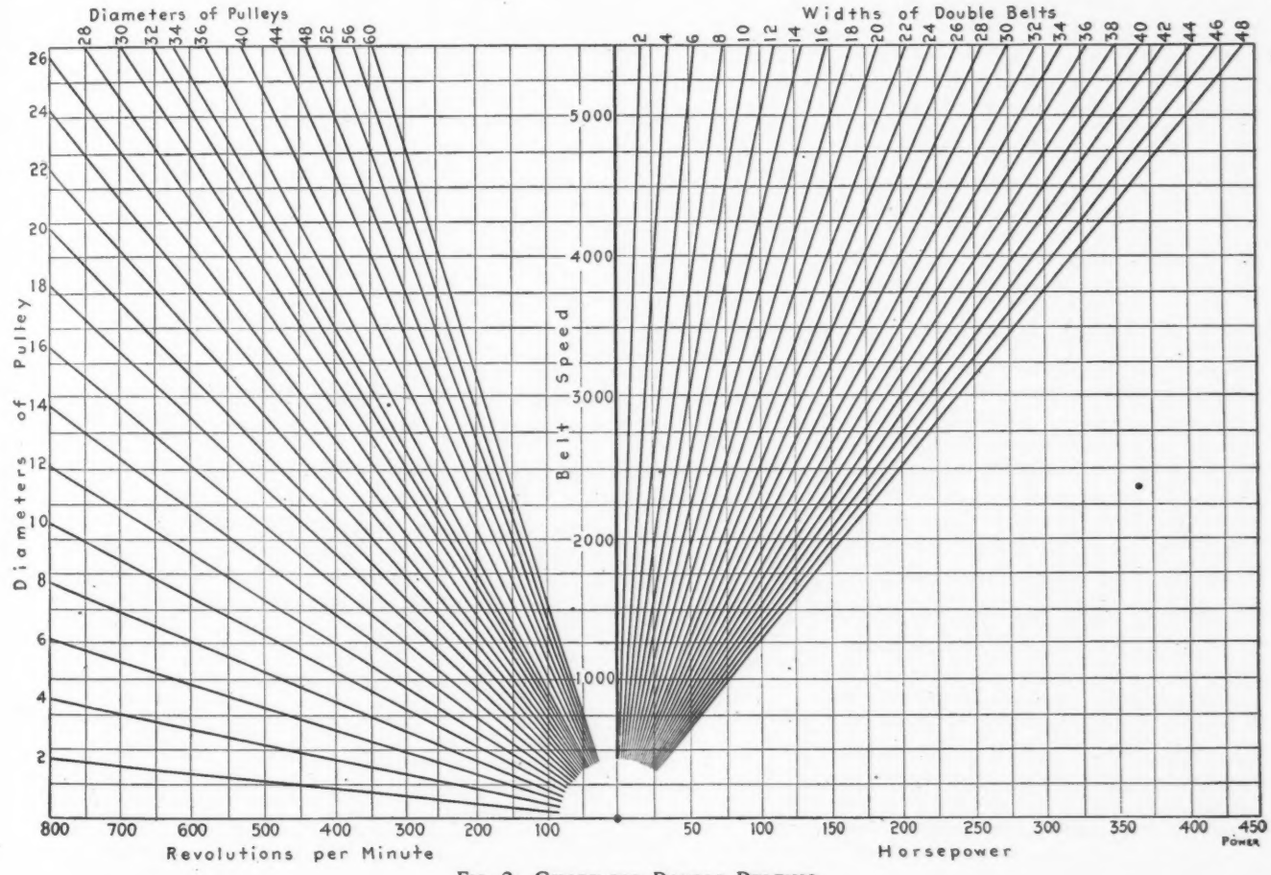


FIG. 2. CHART FOR DOUBLE BELTING

Treatment of Tin Ore in Cornwall

BY ALBERT WASSON

The treatment of ore obtained from tin mines has been developed considerably since the days when the Cornish mines provided the tin of ancient Rome, and there are some remarkable examples now to be found in Cornwall of complete installations for the concentration of the crude ore. It is the purpose of this note to describe a plant which has been installed by the Falmouth Consolidated Mines at its Carnon works near Falmouth, Cornwall, of which the chief point of interest consists of two Humboldt multiple-hearth roasting furnaces. This plant will shortly be increased by a third Humboldt roaster, in order to obtain increased capacity, together with a Humboldt rapid percussion table for the enrichment of the roasted concentration, to improve further the quality of the tin. By the introduction of the roasters only, the quality, and hence the price, of the tin has gone up to a considerable extent, and the roaster is therefore worth detailed attention.

CRUSHED BY BREAKERS AND STAMPS

In the plant under consideration, the crude ore arriving from the mine is first crushed by coarse and fine breakers to about 25mm. and further reduced to below 20-mesh in a 40-stamp battery, the weight of each stamp being 1250 lb. The pulp from the stamp goes after preliminary and suitable classification, over spitz-launders on to shaking tables, round percussion tables and round tables. The concentrates from these tables contain besides tin stone, chiefly iron pyrites, and small quantities of copper and arsenopyrite. The average percentage of metallic tin in the concentrates is 120 lb. per ton. The concentrates are further treated in the following manner: They are fed into a revolving drying trommel, the inside of which is lined with refractory stones, having the firing at the discharge end. In drying the material special attention is paid to fine and coarse concentrates being as uniformly mixed as possible. The dried material is lifted by an elevator into small storage bins placed above two mechanical rotary Humboldt roasters.

Such roasters have recently come

more and more into favor as against furnaces of older types with only one hearth, and consequently less utilization of heat and unsatisfactory roasting results. The furnace consists of a cylinder supported by cast-iron columns and inclosed by a sheet-iron mantle. The inside of the furnace is fitted with refractory lining and divided by fireproof arches into five stories. There is a cast-iron hollow shaft through the axis of the furnace, fitted in each story with rabbling and raking teeth. It is by the arrangement of the rabblers, and the way they are fixed to the shaft, that this furnace offers great advantages over other systems and the condition that the interchange of rabblers should be effected without any disturbance in working is fully accomplished by the Humboldt furnace.

The bottom of the vertical shaft is fitted with holes allowing cold air to enter, which, itself warmed in passing through, effects in this way intensive cooling of the shaft. Driving of the hollow shaft to which the rabblers are fixed, is effected by means of bevel wheel and worm gearing. In the case of several furnaces, as with the Carnon works, two or more furnaces can be connected to a worm drive and provision is made for puttng a furnace in and out of operation by means of couplings. The advantages offered by the new mechanical roasters at the Carnon works against the older types are their simple and rigid construction, minimum space, easy supervision, and low working cost, and last, but not least, to their perfectly satisfactory roasting to the desired degree.

Sulphur in Roast Must Be Below 2%

Since the tin concentrates, after roasting, require further treatment on shaking tables and round tables, to yield pure tin stone, it is of great importance that no crude pyrites are left in the roasted product and therefore roasting of the tin concentrates to at least 2%S is necessary to separate sufficiently the tin stone from the pyrites. In case this degree of roasting is not obtained the output in tin stone is decreased owing to the insufficiently roasted pyrite particles still containing a small quantity of tin stone which is difficult to separate and which for this reason partly goes to middlings and partly to the tailings. In the case of sufficient roasting the pyrites become easily friable and allow separation of the tin stone even if ever so finely ingrained.

The Humboldt roaster is highly adapted to obtaining the desired degree of roasting, warranting the highest output of pure tin stone after washing the roasted concentrate. The two roasters at Carnon are bringing 16 tons of pyritic tin concentrates below ½% in 24 hours; the sulphur contents of the unroasted material is about 25%, but of course not sufficient to generate the required roasting heat without any heat from outside, for which purpose each roaster is fitted with a forehearth the coal consumption of which amounts to 2% of the concentrates fed. The speed of the hollow shaft is 1¼ r.p.m. at a minimum power consumption. The roasted material leaving the furnace is perfectly free from any sintered pieces, whereby it is proved that the Humboldt furnace also in this respect gives highest satisfaction.

The roasted material, after having been moistened with water, goes to two small tube mills, where it is carefully crushed, that is, while the easily friable oxides are being finely reduced the tin stone, owing to its greater hardness, remains uncrushed, and is freed through the rubbing process, of all inclosing particles. The pulp from the small tube mills goes into a small spitzkasten whence the coarser material goes on to shaking tables and the finer on to Acme and round tables. The concentrates obtained from the shaking tables are rewashed on round buddles, and separated into pure tin stone and middlings; the latter are further reduced and definitely treated.

It is proven that since the introduction of the Humboldt roaster the quality of the concentrates produced has improved in a most striking manner, besides an increased output of tin owing to the extremely uniform and thorough roasting. The introduction of this plant, therefore, marks a distinct advance in tin production.

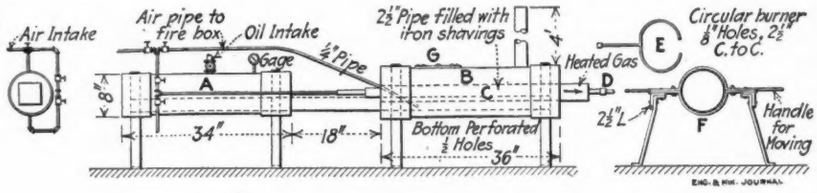
Screen Stamp Battery Feeder to Bypass Fines

At the mill of the East Rand Proprietary Mines, as reported in "Rand Metallurgical Practice," Vol. I, p. 45, a shaking-screen feeder supplies the stamp batteries. This serves to separate, by the aid of a water spray, the fine product (—9 mesh per sq.in.) from the mill ore feed before entering the mortar box. The pulp thus obtained bypasses the mortar box and joins the battery discharge.

Gripping Roll Shells on Cores

When wet crushing is practiced it is generally customary to use wooden wedges to hold roll shells tightly on the cores. The method is entirely satisfactory in such cases since the moisture keeps the wedges constantly damp and consequently tight; in dry crushing the roll shells become heated, causing wooden or iron wedges to work loose. To obviate this difficulty, the practice in the lead district of southeastern Missouri is to grip the shell on its core by means of heat. The shell, with the two conical members of the core in position, is heated. As the shell expands, the bolts of the core are tightened as much as possible, thereby drawing the conical parts into the shell. The contraction of the shell on cooling causes it to grip the core tightly.

The equipment used at the mill of the Federal Lead Co., Flat River, Mo., for heating the shells, is shown in the accompanying engraving. The apparatus consists esentially of a gasoline tank *A*, made of 8-in. pipe; a firebox *B*, made of 10-in. pipe; a gasifying compartment *C*, of 2½-in. pipe filled with iron shavings, within the pipe *B;* the circular burner *E*,



DEVICE FOR HEATING ROLL SHELLS

made of 1-in. pipe, with ⅛-in. holes, 2½ in. apart, punched in its inner circumference. Both gasoline tank and firebox are made of wrought iron; sleeves and plugs are used to make the ends tight. Charcoal is put into the firebox through a 6x10-in. door *G*. A 4-in. pipe, about 4 ft. long, serves as a chimney. The whole apparatus is carried in a frame, which is long enough to support both pipes.

Gasoline is fed to the gasifying compartment with compressed air at 80 lb. pressure. A ¼-in. pipe leading from the air main serves as a blower to keep the charcoal burning in the firebox. The burner is placed around the roll shell and the gasified mixture ignited. It takes about 10 minutes to heat a shell hot enough so that it will grip the cones tightly when it is cooled. The shells give as good service as those tightened by wedges.

At the Doe Run and Leadwood mills a mixture of equal parts of coal oil and gasoline, atomized by compressed air, is fed directly to a circular burner similar to the one described above. This makes a simpler arrangement, but by the use of a gasifying tank a hotter flame is obtained and the gasoline is used more efficiently.

The Cost of Doing Things

Data from Mining and Metallurgical Practice

Lake Copper Co.

According to the annual report of the Lake Copper Co., Lake Superior Copper district, Michigan, for year ended Apr. 30, 1912, the company has expended since its organization in 1905, $1,015,040, of which $162,900 was for mine location and $852,140 for development, construction, equipment and other expenses. Up to date the total receipts amount to $1,074,503, but all of this except $64,310 came from the sale of capital stock. Accounts payable are $2330 in excess of supplies on hand, which brings the total expenditures up to $1,017,370. Copper on hand was valued at $30,380, which, added to the receipts, would make the receipts from sources other than the sale of capital stock as follows: Sale of copper, $73,486; miscellaneous, $8315; interest on bank deposits, $12,889; total, $94,690. In other words, out of receipts from the sale of stock amounting to $1,010,193 there still remains $87,513, indicating that the net expenditures to develop and equip the property to date, after crediting the earnings, amount to $759,780. The development work during the last year included 218 ft. of shaft sinking at an average cost of $129.40 per ft., and 11,538 ft. of drifting and crosscutting at $5.28 per foot.

Kerr Lake Costs

During the year ended Aug. 31, 1912, according to the annual report of the Kerr Lake Mining Co., Cobalt, Canada, 1,855,495 oz. of silver were produced, of which 1,741,804 oz. were from high-grade ore and the remainder from mill ore. The cost of production per ounce of silver was 18.3c.; of this 12.1c. was for mining, 5.55c. for shipment and treatment charges and 0.65c. for administration charges and general expenses. A deduction of $45,000 was made to cover loss on miscellaneous stock or share holdings, which is equal to approximately 2.42c. per oz. of silver produced.

The development work consisted of 4674 ft. of drifts, 609.5 ft. of raises, 197 ft. of winzes and 2252.8 ft. of crosscuts, making a total of 7733.3 linear ft. The cost of development, as represented by the figures given in the cost statement, was about $4.42 per linear ft., but judging from other items in the statement of expense, it is likely that this figure does not include a proportionate charge for such costs as hoisting, tramming, drill steel, etc., which would undoubtedly make the average cost per foot much higher.

Previous cost of production has been as follows: 14.69c. per oz. in 1911, 13.27c. in 1910 and 12.28c. in 1909. The mining and development cost in 1911 was 9.71c.; in 1910, 7.54c., and in 1909, 7.26c. per oz. A metal deduction is made by the smelters which is, in reality, a smelting charge. The deductions made in the last three years are shown in the accompanying table. This indicates an average deduction or difference of about 4.94% on the shipment assays at the mines and the smelter returns. With silver selling slightly above 60c. per oz., this would mean a charge of about three cents per ounce in deductions. The Kerr Lake costs are based upon the silver contents as indicated by shipment assays.

METAL DEDUCTIONS ON KERR LAKE SHIPMENTS

	Mine Assays	Smelter returns	Deductions
1910.....	3,125,400 oz.	2,976,611 oz.	148,789 oz.
1911.....	2,269,680 oz.	2,167,293 oz.	102,387 oz.
1912.....	1,889,042 oz.	1,780,470 oz.	108,572 oz.
Total...	7,284,122 oz.	6,924,374 oz.	359,748 oz.

Barima Mine, British Guiana

By J. Barkley Percival*

A good illustration of the equitable operation of the new gold-mining ordinance in British Guiana is seen from information furnished by the general manager of the Barima mine. From Aug. 1. to Dec. 31. 1911, this mine crushed 5757 tons of ore at a cost of $19,418.18, or $3.37 per ton, which yielded 1161 oz. of bullion worth $20,946.26, or $3.63 per ton of ore crushed. This leaves a profit of $1,528.08 or 26c. per ton. The costs covering the period mentioned are given in the accompanying table.

COST OF ORE CRUSHED, BARIMA MINE BRITISH GUIANA

	Mine Development Cents per ton	Ore Extraction Cents per ton	Milling Cents per ton	Total Cents per ton
Supplies.....	12.9	11.9	4.4	29.2
Salaries and Subsistence.....	7.5	5.2	..	12.7
Wages and Rations.	52.9	56.2	5.6	114.7
Repairs and Maintenance.....	22.7	10.5	0.8	34.0
General Expenses...	12.3	21.9	21.4	55.6
Trucking.....	..	14.8	1.1	15.9
Trading.....	0.1	0.9	..	1.0
Power.....	..	...	49.2	49.2
Crusher.....	..	...	10.1	10.1
Machinery and Plant Stores.....	..	...	2.4	2.4
Bullion Costs.....	..	...	0.9	0.9
London Expenses...	..	...	..	11.5
	108.4	121.4	95.9	337.2

Under the old ordinance of 1903 a royalty of 70c. per oz. of gold produced was collected, whereas under the new ordinance an annual duty of 5% of the profit is required of all companies milling gold ores with an equipment equivalent to 10 stamps or over. Thus under the old ordinance the Barima mine would have been assessed $812.70 or 53% of the total profits, against $76.40 or 5% under the new ordinance. Operation under old conditions in this case would have brought such a small return on the capital invested that a shutdown of the mine would have followed inevitably. In milling this 5757 tons of ore 20 stamps worked 624.6 hours.

*Paramaribo, Dutch Guiana.

Granby Consolidated

The annual report of the Granby Consolidated Mining, Smelting & Power Co., British Columbia, for the year ended June 30, 1912, states that the production consisted of 13,231,121 lb. of copper, 225,305 oz. of fine silver and 33,923 oz. of gold for the year. According to the cost statement given in the report, its cost of producing copper may be figured as follows: Working expenses at mine and smeltery, freight, refining, selling and general expenses, 16.1c. per lb.; foreign ore purchased, 1.2c. per lb.; total, 17.3c.; deducting gold and silver values equal to 6.2c. per lb. of copper makes a net cost for operating of 11.1c. There was a depreciation charge of $600,562, or 4.5c. per lb. of copper, which brings the total cost of production to 15.6c. per lb. of copper produced.

During the year $48,266 was spent on new construction and equipment at the mines and smeltery; 6365 linear ft. of development and 6311 linear ft. of diamond drilling were performed. The new construction was equal to about 6.5c. per ton of ore treated at the smeltery. The entire plant was closed down for four months and six days on account of a shortage of coke. Assuming the production to be maintained at the rate for the time worked, the normal year's production should be about 1,180,000 tons of ore, including purchases of custom ore.

The total cost per ton of ore treated, including custom ore purchased and depreciation, was about $3.90 per ton. It is

stated that the average mining cost, including development, was 74.4c. per ton during the last six months of operations, the average for the entire period was 77.1c. It is estimated that during the winter the expenditures for mining should average $12,000 per month, and that one diamond drill in operation should average about 1000 ft. of drilling per month.

In the smelting department a change was made in the method of handling slag; formerly the slag was hauled and dumped hot; it is now granulated, the water carrying it to the bins centrally situated, where it is dewatered and then conveyed up an incline 100 ft. above the present dump by conveyor belt and stacked. The first cost of this installation was $44,256. The regular supply of coke used at the Granby smeltery comes from Crow's Nest, the eastern coke used in time of shortage costs $10.55 per ton, at Grand Forks, B. C. About 261 lb. of coke are used per ton of ore smelted.

The ratio of foreign ore treated is approximately one to 40.5 tons of Granby ore; converter slag and matte about one to 26 tons of ore smelted, and flue dust one to 167 tons of ore treated. In the converter department during the period operated, the cost was 8.4c. per ton of ore, which would figure about 0.47c. per lb. of copper produced. This department handled 19,500 tons of 33.9% matte. The average cost of smelting was $1.256 per ton, as compared with $1.172 in 1911 and $1.187 in 1910. The cost during the last five months was reported as $1.20 per ton. The average loss of copper in slag was 4.2 lb. per ton.

Low Converting Costs

The low costs that are being obtained in the converting of low-grade matte in acid-lined converters, at Kennett, Calif., are noteworthy. At the plant of the Mammoth Copper Mining Co., the 15 or 20% copper matte is being converted at a cost of about 0.75c. per lb. of copper. In plants where a small amount of low-grade matte is thus converted the costs are often as high as 1 or 1½c. per lb. The low cost obtained at the Mammoth plant is due to the use of a very good lining material and to feeding into the converter a large amount of loose siliceous ore. Doubtless a lower cost could be obtained in converting the Mammoth low-grade matte in basic converters, if there were a sufficient quantity of such matte to make a really large-scale operation. It has been figured, however, that the saving on converting the comparatively small quantity of matte would not justify the basic-converter installation and the royalty asked. It should, of course, be borne in mind that these costs do not compare with those obtained on higher-grade matte in either basic or acid converting.

Broken Hill South Silver Mining Co.

The following data are from the report of the Broken Hill South Silver Mining Co., Broken Hill, N. S. W., for half-year ended June 30, 1912. The total number of employees engaged during the period amounted to 1391, of whom 379 were employed on the surface and 1012 underground. The daily attendance, however, averaged only 1120, or about 80.6% of the employees. Of the 379 surface men only 351, or 92.6% were in daily attendance, and of the 1012 underground men 769 men, or approximately 76%, were regularly at work. The major portion of the men employed underground were on contract and their average earnings per eight-hour shift were: Miners in development, $4.40; miners stoping, $3.70; truckers handling ore, $3.18; truckers handling mullock, $3.12 per shift.

During the period mentioned, 165,995 tons of ore were mined; of this amount 96.9% was secured by contract labor, 1.2% by wage labor, 0.1% preparatory to stoping and 1.8% from development. In trucking this ore to the shaft, 98.8% was handled by contract. These figures indicate that the average annual output per man employed underground is equal to about 332 tons. The development work consisted of 2515 linear ft. of drifting, winzes, crosscuts, etc., including 172.5 of shaft sinking, which is equal to about one foot of development work for every 66 tons of ore produced, including ore from development at the rate of 1.19 tons per linear foot performed.

A total of 48,664 cu.yd. of filling for stopes, consisting of 42,811 yd. of tailings, 1489 yd. of ashes and 4364 yd. of waste from development, were sent down for distribution in stopes. The total cost of purchase, handling on surface and conveying to depleted stopes was $1.22 per cu.yd. of filling, compared with 91c. for half-year ended Dec. 31, 1911. The cost per ton of ore for filling during the two periods was 35c. and 32c., respectively. The consumption of water amounted to 31,629,400 gal., which is equal to about 192 gal. per ton concentrated. The working costs were: Mining, $3.13 per ton; filling depleted stopes, 35c.; development, 38c.; and concentrating, 91c.; a total of $4.77 per ton. The cost per ton of concentrates was $29.72 per ton.

Cananea Consolidated

Herbert S. Kohlberg, of Pilares de Nacozari, Sonora, Mex., calls attention to certain errors in calculation present in the last paragraph of the article under the above caption, which appeared in the JOURNAL of Oct. 26, 1912. Instead of 119 cu.ft., 140.6 cu.ft. and 281.2 cu.ft. per man-hour, respectively, for mucking and tramming, for mucking from a plat and tramming, and for loading from a chute and tramming, the figures should be 35.8, 42.2 and 84.4 cu.ft., respectively.

Iron Mining in Swanzy District, Michigan

The Swanzy district is in Marquette County, Michigan, and has been described by Doctor Leith as an isolated canoe-shaped basin of Upper Huronian rocks surrounded by granites, south of the Marquette district. The axis of the basin is northwest-southeast with minor cross folding. The ores are in tabular deposits with gentle dip. The Cleveland-Cliffs Iron Co. controls all the mines of the district except the Stegmiller, a property owned by the Oliver Iron Mining Co. Besides this property the other principal mines are the Stephenson, Austin, Princeton No. 1 and Princeton No. 2. During a five-year period, 1906-1910, these mines shipped 1,670,263 tons of ore.

The total profits from profitable operations amounted to $1,047,803, and unprofitable mines, including developments, showed a loss of $528,496. Mr. Finlay's appraisal of the mines of the district, $2,530,000, was based on an expected tonnage of 6,746,158, or a yearly output of 456,000 tons. The average cost of producing ore in this district and delivery to Cleveland, basing the average value of the ore at 100%, was as follows: Mining, 49.4%; exploration and development, 2.2%; construction, shafts, machinery, etc., 2.5%; general expenses, including administration, 2.5%; royalties, 8%; taxes, 1.5%; rail freights, 10%; lake freights, 16.2%; a total of 92.3%, indicating an average profit of 7.7% of the average value of the ore.

Burma Mines

The 1911 annual report of the Burma Mines, Ltd., Burma, India, states that the development work consisted of 83 ft. of shaft sinking, 4.5 ft. of winzes, 1558.5 ft. of drifting, 611 ft. of crosscutting and 78 ft. of "plat culling," a total of 2335 ft. According to the figures given in the profit and loss statement, this work was performed for an average cost of about $19.75 per ft. The total tonnage extracted from the mines was 3917 tons, at a cost of about $1 for stoping. Old lead slag is being recovered from a stream below Bawdwin and treated; 6717 tons were recovered at a cost of 71c. per ton for sluicing. Recently the smeltery was moved to Nam Tu, in the vicinity of the mines. The first smelting works was brought into commission about Dec. 10, 1911; the cost of treating 1619 tons of slag and ore during the initial run was $5.73 per ton, as compared with $5.89 at the Mandalay smeltery, where 34,340 tons of ore and slag were treated.

Cyaniding at the Dome Mill

By Herbert A. Megraw

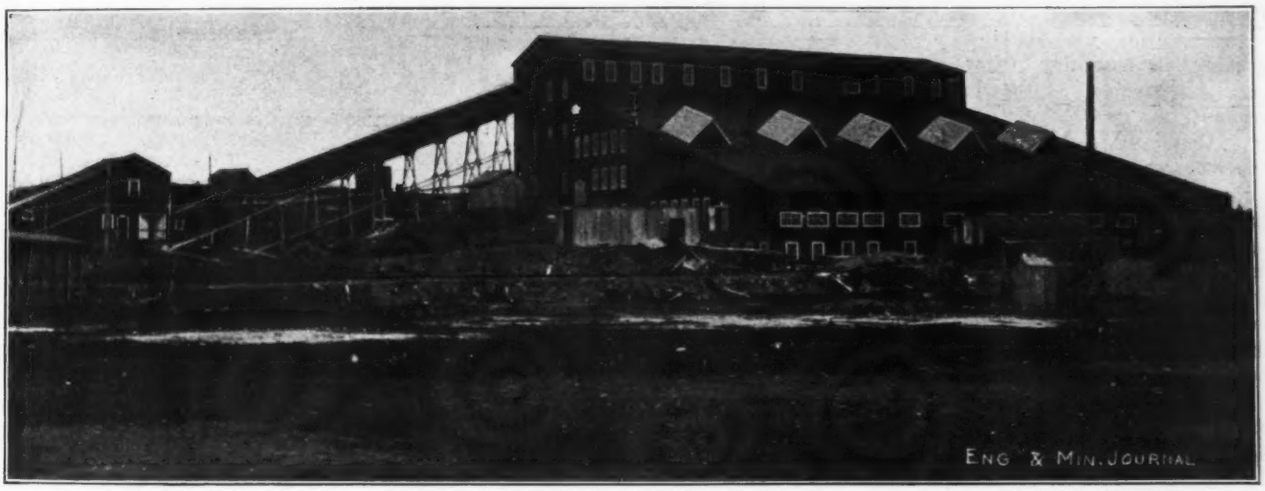
A modern mill for cyaniding gold ores in the Porcupine district, Ontario. The predominant feature is a crushing and grinding system of circulation in water, entirely separate from the treatment in cyanide solution. Weak cyanide solution is used to dissolve gold by agitation in unusually tall and narrow Pachuca tanks. Zinc-dust precipitation is practiced. The pressure filter installation is eminently satisfactory but could be improved by giving the cake a water wash. Melting and refining of precipitate are done in blast furnace and cupel.

Note—This is the second of a series of articles on American cyanide practice by Mr. Megraw. The first article appeared Nov. 2, 1912.

The property of the Dome Mines Co., Ltd., is situated about 2½ miles west of the town of South Porcupine, Ont. The property is famous as the first discovery in the district, and has been the subject of great interest and discussion among mining men. It has been developed for some time, and is now equipped with a modern mining plant, a power plant, a modern 40-stamp mill and cyanide plant, started in March of this year.

Orebody is Quartz and Schist

The ore is white quartz and schist, the quartz occurring as stringers and veins of various width running in different directions through the schist country. Within the payable zone the rock is so impregnated with gold that no attempt is made to separate it, the whole product being sent to the mill as mined. The ore is similar in character to that of the Hollinger mine, but the Dome ore is harder, though it does not reach a point where it could be called difficult to crush. In common with the ores of the camp and district in general, it has a high specific gravity, the dry slime treated in the mill having a specific gravity of about 2.8, and the resultant slime is largely granular in character. It has been determined that the pulp under treatment contains about 35% colloid slime, the rest of the product being granular and heavy.



The Dome Mill, Porcupine District, Ontario

A Modern Steel-frame Mill

The mill is a modern structure with steel frame, concrete foundations and floors, and, a feature which is often forgotten in mill construction, excellently lighted with windows and skylights, making it easy and convenient to work in any part of the mill without artificial light in the day time. In view of the prevailing gloomy weather of the district, this is a distinct advantage tending toward more and better work and has a real value in dollars and cents. The building is heated by steam, a separate boiler installed in the mill for that purpose being of sufficient size to make the building comfortable at all times.

The ore going to the mill comes from two different places, two sets of tracks entering the crusher house. The crusher house is separate from the mill and is on the ground level. The ore, entering in cars moved by a hoist with an endless wire rope, is thrown first into a No. 7½ Kennedy gyratory crusher. This crusher discharges to a grizzly with 1½-in. openings. The oversize is put through two No. 3 Kennedy gyratory crushers. All the ore, after passing through these crushers, will pass a 1½-in. ring. This is somewhat smaller than is usually necessary for feeding stamps, but in the case of the Dome ore experience has proved that if crushing is not rather fine, slab-shaped pieces of ore are likely to pass through the crushers without being sufficiently reduced. To avoid this condition, the crushers are set rather close, and the result is that the product is all of a good size to go through the feeders and into the mortars.

Ore Delivered to Mill on Belt Conveyor

The ore from the final crushers falls upon an inclined belt conveyor by means of which it is carried into the mill bins. The belt is 20 in. wide and rises at an incline of about 20½°, the belt traveling at the rate of 350 ft. per min. At the point where the conveyor enters the mill the conveyor way is closed with an iron door and a heavy iron wall is interposed between it and the mill building, only a small opening being left through which the belt passes. This arrangement is for protection against fire, the crusher house and the conveyor way not being constructed in a way to resist fire as the rest of the mill is. The halftone engraving shows the conveyor reaching from the crusher house to the mill.

The inclined conveyor delivers the ore to a second conveyor which reaches across the bins. The second conveyor is provided with a tripper so that the ore can be delivered into any desired part of the bins. This belt is also 20 in. wide.

The mill bin is of steel construction and has a flat bottom. It has a capacity of about 1500 tons of ore and is placed

back of the stamps. The ore going to the bins is not weighed, but carloads are weighed at intervals and an estimation of the quantity is made. A rough sample of the coarse ore is taken, also one of the pulp issuing from the battery at the lip of the mortar, but no absolute system has been devised to record the content of the ore milled. According to the general results obtained it may be said that the ordinary milling ore averages about ½ oz. in gold.

Entire Crushing System Uses Water

From the bins the ore is fed into 40 1250-lb. stamps by means of suspended Challenge feeders. The stamps drop through 6½ in. 100 times per minute and crush through a rolled slot wire screen equal to 10 mesh. On this ore and with the screen mentioned the stamps have a capacity of 10 tons per stamp per day, but owing to the limitations of the cyanide plant the actual crushing is a little under that figure, the 40 stamps crushing generally about 380 tons per day. Water is used in crushing at the rate of about 6½:1 of ore.

Just outside the batteries are the primary amalgamating plates, one for each ten stamps, 54x144 in., in two sections, the grade being 1½ in. per ft. These plates are intended to recover coarse gold coming from the batteries, in which there is no provision for amalgamation, but due to the scouring effect of the heavy rush of coarse pulp they are of little use. One of these plates has already been experimentally discontinued and it is likely that the others will be put out of commission.

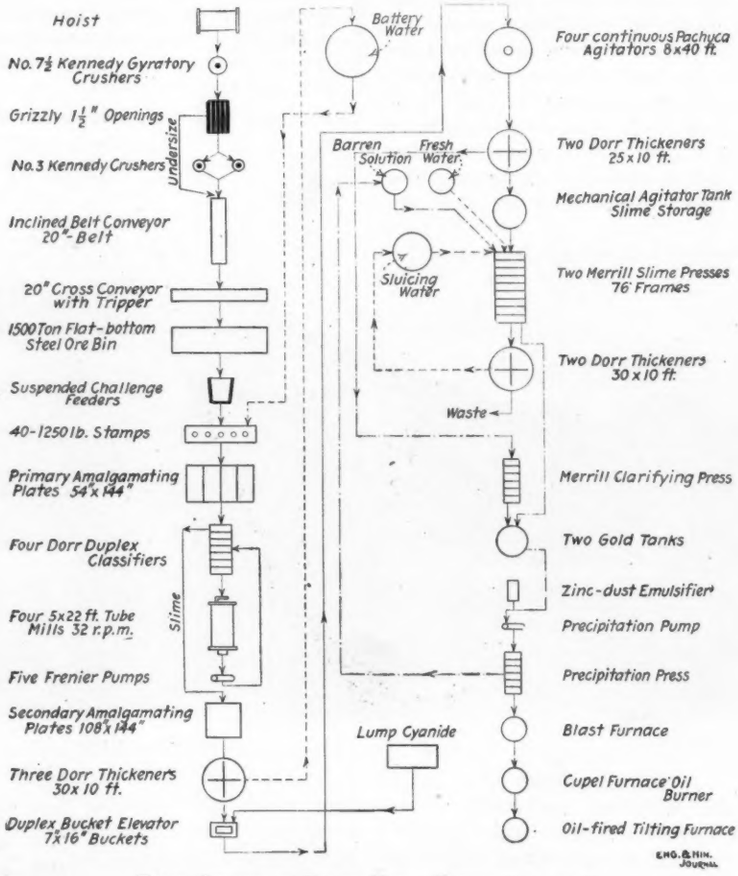
From the primary plates the pulp is passed through four Dorr duplex classifiers where the sand is taken out and sent to four Allis-Chalmers tube mills, each 5x22 ft., having spiral scoop feeders and reverse-spiral discharge, which tends to prevent pebbles issuing from the mill and also is convenient for the introduction of the regular daily addition of pebbles which can thus be fed into the discharge end of the mill without trouble. From the tube mills the pulp is returned to the Dorr classifiers by means of five Frenier pumps, each 8x54 in., the tube mills and classifiers thus being in a closed circuit. The tube mills make 32 r.p.m., which is somewhat excessive, the general speed of mills of this size being about 28 r.p.m. Due to the weight of the pulp it may be fed into the tube mills somewhat thicker than in usual practice.

From the classifier the fine pulp, or slime, goes over a second series of plates, called the secondary plates, where amalgamation takes place. These plates are 108x144 in. with a slope of ½ in. per foot. On these plates under present conditions of operation about 60 to 65% of the gold content of the ore is recovered.

The whole of this crushing and grinding operation is carried out in water, the reason being that a flow of cyanide solution is believed to be prejudicial to good work on the amalgamating plates.

Pulp Thickened Previous to Cyanidation

From the secondary plates the pulp is led to three Dorr thickeners, each 30x10 ft., where the pulp is thickened as much as possible, the usual effluent being about 1:1. From the thickeners it goes to the boot of a duplex belt-and-bucket elevator, 70 ft. between centers and carrying



Flow Sheet of Dome Mill, Porcupine, Ont.

7x16-in. buckets. This elevator delivers to the agitation system.

In the boot of the elevator the cyanide necessary for treatment is added, the material in lump form being suspended in the flow of pulp where it dissolves. The solution is made to a strength of one pound per ton of solution, the average consumption in total being about 0.8 lb. per ton of ore treated. The dilution ratio varies between 1:1 and 1½:1.

The classification of the pulp going to agitation is about as follows: +100 mesh, 8%; +200 mesh, 32%; —200 mesh, 60%. The fineness of grinding is controlled entirely by the comparison of cost and recovery, and the most efficient condition for both considerations has been found to be the condition above stated.

The water from the pulp is returned to the battery circuit for further use, the circulation being maintained separate. It is of course necessary to take out as much water as possible from the pulp which is to go to cyanidation treatment, in order that the consumption of cyanide shall be as low as possible.

Agitation in Pachuca Tanks of Special Design

For agitation of the pulp Pachuca tanks are used, but the design varies from the usual standard. These tanks are 8 ft. in diameter and 40 ft. deep, resembling a chimney more than a tank. This form was adopted in view of the especially heavy character of the slime to be treated, it being considered that in a wider tank there would be danger of settling of the solids. It is stated that 35 to 40 lb. of air pressure is sufficient to secure satisfactory agitation in these tall tanks. They seem a peculiar form of agitator, but if they are, as is claimed, the most satisfactory form for agitating this heavy pulp, no criticism can be made of them.

The agitation is continuous through the

Pachuca tanks, of which there are four, the last tank being arranged so that its overflow may take out a quantity equal to that which enters the tank, or may be changed so as to take out more or less, according to the desirability of increasing or reducing the amount of material in the tank. The dilution of the pulp during this treatment is from 1:1 to 1½:1 and varies somewhat in accordance with the work of the thickeners. The height of these tanks results in an advantage in that a considerable fall is secured to the filters, allowing them to be filled by gravity.

The pulp from the agitation system goes into two Dorr thickeners, each 25x 10 ft., where the pulp is thickened for filtration and then into a mechanical agitator tank where the slime for filtering is stored, the slow agitation preventing the solids from settling in the tank. The overflow from these two thickeners is passed through a Merrill clarifying press and is precipitated.

DOME MILL CRUSHER HOUSE AND INCLINE IN FOREGROUND

Glass bottoms are used in many of the launders at the Dome mill in order to facilitate the flow of pulp. It has been shown that with the same grade a launder having a glass bottom runs cleaner and easier and at the same time lasts longer than one without it. The glass seems to reduce friction, so that often a launder which gives trouble when made of wood or iron will flow easily and without trouble when glass bottoms are put in. A sudden drop or fall of the pulp on glass must be avoided, for in such cases the glass grinds out sooner than when iron is used. The cost is low, scrap plate glass being used, which may be bought for about seven cents per foot for pieces of various length 12 in. wide.

MERRILL PRESSURE FILTER USED

The pulp is led from the mechanical agitator to two Merrill slime presses, standard type, having 76 frames 4 inches thick. The press is filled by gravity and the slime being thick, there is no segregation and a homogeneous cake is made. Once made, the cake is washed with barren solution, an amount equal to the weight of the cake being used. During this wash there is an appreciable additional solution of gold. After the solution wash the cake is discharged, there being no actual water wash in the press, but as it requires four or five parts of water under 80 lb. pressure to discharge the slime, there results a form of washing, as most of the water is afterward recovered in the two Dorr thickeners, each 30x10 ft., through which the sluicing mixture is passed.

Only an equal amount of water is discharged with the slime, the rest being recovered from the thickeners and used again to sluice out the presses. The amount of wash water discharged is about equal to the quantity of water taken into treatment from the crushing system. The slime is discharged from the thickeners by gravity. This system is well adapted to the character of the pulp, the heavy solids having no time to settle previous to filling the press, with the result that a cake which can be thoroughly washed with solution is formed.

ZINC DUST PRECIPITATION USED.

The Merrill system of zinc-dust precipitation is used, the zinc being added to the solution from the clarifying press which passes to the two pregnant-solution sumps, from where it is pumped into the precipitation press, which has ten 2-in. frames. The zinc is added by a spiral-screw conveyor which feeds the dust into a miniature tube mill where an emulsion of solution and zinc is formed, this emulsion going into the stream of solution entering the pump.

The amount of zinc added is approximately ⅛ lb. for every ton of solution. As there are about two tons of solution precipitated for every ton of ore treated, the consumption of zinc is about ¼ lb., or approximately two cents per ton of ore milled.

A small amount of lime is used in the treatment, the system being the formation of milk of lime by placing the dry pulverized lime in a barrel and adding a constant stream of solution, the outgoing solution, or milk of lime, entering the treatment at the desired points. About three-fourths of the total lime consumption is added to the thickeners which prepare the pulp for the agitation treatment, this being to assist settlement and aid in the production of a thick pulp; the remaining one-fourth is added to the thick pulp going to treatment. The total consumption of lime is a little under three pounds per ton of ore treated, as the ore is not extremely acid, and the lime is used more to assist settlement than for any other purpose.

A total of approximately 95% of the gold content of the ore is recovered, about 65% of which is recovered on the plates as has been mentioned, and the remaining quantity in the cyanide treatment. The percentage recovery is governed by the economic question, there being no difficulty in recovering 98 or 99% of the gold if it is desired to do so. Experience has shown that it is more advisable to stop at the point now established than to attempt to extract more of it. The costs established are proportionately less than if the higher extractions were obtained.

The power used by the company is generated in their own power house by steam, using coal as fuel, and is higher than would be the case were hydroelectric power available. It is expected that such power will be delivered at the plant within the next few months, when a corresponding reduction of cost is expected. Detailed treatment costs are not given at this time as such figures to be of any service should be representative of permanent conditions.

PRECIPITATE MELTED IN BLAST FURNACE

The precipitate is melted in a small blast furnace with litharge, the resulting lead bullion being afterward cupelled in an appropriate test. The cost of this system of refining seems to be less than the older method of direct melting and a practically fine bullion is obtained, with the advantages which come with a product of that kind. The lead stack is easy to operate and does not entail the severe labor attendant upon pot melting, and the cupelling operation is also comparatively clean and convenient. A comparison of the cost will add the deciding factor, and I expect to give especial

attention to this matter in future papers on the subject.

At the Dome mill the cupelled bullion is melted and made into bars in a small oil-fired tilting furnace. For this purpose the tilting furnace is satisfactory.

The cupel furnace is heated by means of an oil burner, but the operators consider that it is not as satisfactory as when wood fuel is used. The cupel itself is made of a mixture of ground limestone and Portland cement in the proportions of about 1: 3, which makes a properly absorbent test. The saturated portions are melted down in the blast furnace together with scraps, sweepings, etc., in a scavenger run which is made at intervals.

Points for Discussion

The first point in the Dome mill which is open to criticism of any kind is the fact that no accurate weighing or sampling is done on the ore which enters the mill. Estimations are made, but these can hardly be considered an effective substitute for absolute methods and probably much more satisfaction would be obtained with accurate weighing and sampling systems such as are being installed in the newer mills. The pulp from the Dorr thickeners, going to the agitation treatment is estimated by measurement and specific gravity determinations which are taken at regular intervals and the operators believe that in this way a good estimate of the tonnage is obtained.

Pachuca tanks as here used seem to be a subject for some discussion, but personally I think there might be some more satisfactory and economical method of obtaining the same result. I am not convinced that Pachuca tanks are most efficient agitators, particularly where the time of contact is short and where great agitation is not necessary. The fall for the filters could as well be secured by using tanks of different form, even if the elevation were made equal to that now obtained.

A comparison of the design of the Hollinger and Dome mills presents a good illustration of two ways of doing the same thing. In both mills the original design contemplated the removal of coarse gold which might not be dissolved in the cyanide solutions and which, it was feared, might be discharged undissolved with the residues. At the Hollinger the attempt was made to extract this coarse gold on concentrators, while at the Dome mill the same result is sought through the medium of amalgamating plates. It is probable that neither system is necessary.

At the Hollinger mill it has been demonstrated that this coarse gold is more than likely to be retained in the tube mill as long as it is coarse, and being there scoured and subjected to attrition it is generally reduced and dissolved. The concentration system is already under suspicion of being useless and may be dispensed with. At the Dome the system of amalgamation on plates is done in water which has to be carried through the whole grinding system and this presents the serious defect of losing the dissolving effect of the solution during crushing and grinding, and particularly the highly efficient dissolving action of the tube-milling operation.

I am of the opinion that the simplification of the mill through the discarding of the plates and grinding directly in cyanide solutions would obtain a result as good or better than the one now in use and perhaps at less cost. A great advantage about the latter system is that not so much water would be necessarily taken into the circulation. None would be taken in through milling and what water is required could be taken into circulation through giving the filter cake a water wash. This would reduce the loss in dissolved gold and also the mechanical loss of cyanide, which constitutes at present about two-thirds of the total loss.

The logical addition of water to milling systems is through the filter cake where it will do the most good, and not into the agitation circuit where it merely dilutes solutions and necessitates the addition of cyanide to keep strengths up to normal.

It is still an open question whether or not economies could be introduced by using a system of partial leaching, agitating only the natural slime formed during grinding and passing the fine, granular solids to a leaching system. This question can only be solved by a series of experiments establishing the point to which grinding must be carried to liberate the maximum quantity of gold and the desirability of either leaching or agitating the fine sand, according to cost.

The filtration system at the Dome mill, using the Merrill pressure filter, is the best I have seen in Canada. The character of the pulp makes the machine especially applicable to handling it, and filtration is performed at a minimum expense and with beautiful simplicity. The pressure system ought to be installed in all mills to be built even if it does not displace vacuum plants already installed. With the change from the Dome practice of adding a water wash to the cake, it seems to me that most admirable results might be obtained.

At the Dome mill the metallurgical difficulties are negligible. The problems are all mechanical, due to the handling of the heavy pulp and the devising of a system of manipulation which will give the highest economy.

Hardenberg Mine, California

San Francisco Correspondence

The reopening of the Hardenberg mine, near Jackson, Amador County, Calif., has reached a point which warrants the erection of a 20-stamp mill now in course of construction by Knight & Co., at Sutter Creek. The mine is one of numerous old producers in the Mother Lode region that have lain idle for a number of years. It is situated north of Mokelumne River, about four miles south of the Kennedy mine, which is in Amador County, and about three-quarters of a mile east of the Gwinn mine, which is in Calaveras County. The old mine was worked by inclined shaft to a depth of 900 ft., and is reported to have paid dividends on ore crushed in a 10-stamp mill, averaging about $8 per ton. The old shaft was sunk on the foot wall following the vein at a dip of about 62° east.

The new vertical shaft has three compartments and is 1078 ft. deep; it is sunk on the hanging-wall side of the vein. According to the old surveys the vein should have been encountered at a distance of 220 ft. from the new shaft. A drift at the 1070-ft. level cut the vein at a distance of 215 ft. west. Since the west drift was driven a drift has been run to the south for a distance of 100 ft., and has encountered a good vein, showing the true Mother Lode characteristics, as in the west drift. The hanging wall is in schist slate, the foot wall black slate. The ore averages by assay $5.58 per ton and is from 4½ to 7 ft. wide.

A bond was taken on the Hardenberg and adjoining claims by John Martin and H. Malloch, of San Francisco, in November, 1910. They first equipped the property with hoist, compressor and motors, making the equipment equal to the demands of a 40-stamp mill. The hoist has a double-drum carrying ⅞-in. cable and is capable of hoisting from a depth of 2000 ft. The compressor is 10x16x14, Ingersoll-Rand machine. The installation of electric power was begun in March, 1912. In starting the new shaft, hand drills were employed. Later four 2¾-in. Pacific drills were installed, and two more have since been added. Electric power is furnished by the Pacific Gas & Electric Co., generated from Mokelumne River, about 3½ miles east from the mine.

At the time of reopening the mine the old shaft was closed, making entrance to the mine through that working impossible, so that the new operators had only the surveys and early history of the mine as a guide to the proposed development. The mine is now capitalized at $300,000, and articles of incorporation were filed Sept. 25, 1912, by H. Malloch, John Martin, W. S. Coleman, L. W. Pryor, A. H. Reddington, of San Francisco. N. S. Kelsey, of Jackson, is superintendent.

Determining SO_3 in Flue Gas

By F. G. Hawley*

The ordinary methods of gas analysis for SO_3 in presence of SO_2 are based on an indirect determination, and subject to the usual errors of such methods. The method herein described depends on filtering the SO_3 out from the SO_2 and then determining it.

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When analyzing smelting and roasting gases I have had occasion to make a number of determinations of small amounts of SO_3 in presence of much larger quantities of SO_2. Several of the methods usually used for this determination were tried but none proved satisfactory, so a new method was worked out which seems to be an improvement on those previously described.

Hempel's Method an Indirect One

The method first tried was that given in Hempel's "Gas Analysis," in which are the following directions:

> To determine sulphur trioxide in the presence of sulphur dioxide, the mixture of the two gases is led through a standard solution of iodine; the amount of iodine acted upon by the sulphur dioxide is determined with sodium arsenite, and after acidifying with hydrochloric acid the sulphuric acid is precipitated by barium chloride.

One disadvantage in this method which is common to all indirect methods is that an error in determining either the SO_2 or the total S will affect the SO_3. As the SO_3 is very small compared to the total S, the error even with careful work, may easily be greater than the total SO_3 present. An example may make this clearer: Suppose the total S is 104 mg. and the S in SO_2 is 100 mg. This gives 4 mg. of S to form SO_3. Now if the total S were reported as 106 mg. and the S in SO_2 as 98 mg. there would then be 8 mg. of S reported as SO_3, or if the errors were reversed, there would be no SO_3 found.

Also while this method estimates the total SO_3 present it does not indicate how much is present as free sulphuric acid and how much combined as sulphates; an appreciable amount of the latter is always present in furnace fume or roaster gases. A further disadvantage is that the SO_3 is surprisingly hard to absorb; unless unusual precautions are taken, some will escape.

Another indirect method which has some of the same objections as the one just given is that found in the "Technical Chemist's Handbook" by Lunge. In this method the gas is passed through a $N/10$ solution of sodium hydroxide containing some phenolphthalein indicator, until it is neutralized. This gives the total acidity. The SO_3 is determined by bubbling the gas through a $N/10$ solution of iodine. The acidity due to SO_3 is now subtracted from the total acidity, the difference giving the amount of SO_3.

CO_2 Bars Phenolphthalein as Indicator

An objection to this method is that it cannot be used on furnace gases because of the action of CO_2 on phenolphthalien. Even in roaster gases, for which it is recommended, there is likely to be some CO_2 formed by the oxidation of small amounts of organic matter usually present in ores, as well as from small amounts of carbonates which may evolve CO_2 during roasting.

Sulphates of the heavy metals are always present in the fume and will react acid to phenolphthalien and thus affect the result.

Another method tried, which determines total SO_3 but does not indicate how much is present as H_2SO_4 and how much combined as sulphates is as follows: Slowly pass the gas through a solution of $BaCl_2$ acidified with HCl, collect and weigh the $BaSO_4$ formed. When this is done in a cold solution, the $BaSO_4$ precipitated is too fine to filter satisfactorily, and it is usually not practicable to pass the gas through a hot solution at the place of sampling the gas.

Dissolved SO_2 Can be Expelled by CO_2

When the gas was passed into water, either with or without first acidifying, and the solution boiled before adding $BaCl_2$, it was found that some of the SO_2 was slowly oxidized to SO_3. This can be overcome by expelling the SO_2 from the cold liquid by bubbling CO_2 through it for about 30 min., but this makes the method tedious.

The following experiments were made to test this: Pure SO_2 was prepared and from 20 to 400 c.c. passed into 100 c.c. of distilled water contained in wide-necked bottles. When CO_2 was passed through the cold solution to expel SO_2 and the liquid then acidified, boiled, and $BaCl_2$ added, there was no trace of a precipitate formed, but when it was attempted to expel the SO_2 by boiling, either with or without first acidifying with HCl, it was found that from two to four milligrams of SO_3 were always formed.

This amount was about the same whether there was much or little SO_2 present. It was less when the liquid was heated quickly and more when heated slowly, or when the liquid had stood for some hours before heating.

The oxidation is apparently caused by atmospheric oxygen, as precautions were taken to insure the absence of all other oxidizing agents.

If the precaution is taken to expel the SO_2 by means of CO_2 before determining the SO_3, this method is accurate, although too long for ordinary work. It may be used to advantage in checking other methods.

New Method Based on Filtering Out SO_3

In working out the method now used, advantage was taken of the fact that SO_3 at ordinary temperature is a solid and not a gas. This will combine with H_2O, either liquid or vaporized, to form H_2SO_4. At the temperature at which the flue gas passes through the apparatus the SO_3 is in the form of minute particles of fume which may be readily separated from SO_2 and other gases by a properly arranged filter.

The details of the method are as follows: Place a double Munktell's filter No. 0, about 3½ in. in diameter between two 3-in. glass funnels with their large ends placed together. The rims of the funnels are held in place and the joint made air-tight by means of a strip of sheet rubber would around them. Electrician's tape might answer in place of the sheet rubber.

Before placing the funnel together a little water is run through the stem of one of the funnels so as to moisten it; after joining the funnels by means of the rubber the stem which has been moistened inside is heated in a small alcohol flame and at the same time a current of air is drawn through the funnels. The water is vaporized and part of it condenses on the filter. There should be enough to moisten the paper slightly but not enough to make it wet, as this would prevent the gas from freely passing through the filter. besides weakening the paper so that it might break.

By means of a short rubber tube connect one end of the filtering apparatus to a glass, or better, a fused-silica, sampling tube. Connect the other end to an aspirator capable of measuring the amount of gas taken. Draw four to 10 liters of the gas through the filter at the rate of about one liter per minute.

When the required amount has passed disconnect the sampling tube and draw about one liter of air through to expel all traces of SO_2 from the filter. Remove the paper and place in a wide-mouthed glass bottle. As some sulphuric acid will

usually condense on the glass and rubber, rinse the inside of the funnel and tubes into the bottle containing the filter. This is taken to the laboratory and the contents diluted to about 100 c.c., a little methyl-orange indicator added, and then titrated with $N/10$ sodium-carbonate solution until neutral. The H_2SO_4 is calculated from the amount of Na_2CO_3 used. Phenolphthalien cannot be used for an indicator as the sulphates of the heavy metals react acid to it.

If it is desired to determine the combined SO_3 present it may be done by acidifying the solution with HCl, filtering and precipitating the total S with $BaCl_2$. After deducting the S equivalent to the H_2SO_3 from the total S, the balance is calculated to SO_3.

Proof of Correctness of Method

The method was tested as follows: H_2SO_4 was heated to boiling in a flask and the fumes, mixed with air, passed through the filter, then bubbled through water and then passed through moist glass wool. In front of the filter, the air in the funnel appeared foggy from the dense fumes of SO_3, but after passing the filter it seemed absolutely clear. No acidity could be detected in the water beyond the funnels, through which the air had bubbled, or in washings from the moist glass wool, while 12 mg. of H_2SO_4 were found on the filter and sides of the tube and first funnel.

A similar test was made on SO_3 obtained by heating potassium pyrosulphate to dull redness. No acidity could be detected in the water of the absorption apparatus beyond the filter.

A quantitative test was then made by heating small known quantities of H_2SO_4 in a hard glass tube and passing the fumes, mixed with air, through the filter and determining the acid caught by means of a standard solution Na_2CO_3.

Grams	Grams
No. 1 Took 0.064	Found 0.060
No. 2 Took 0.050	Found 0.047
No. 3 Took 0.034	Found 0.032

At first it was feared that the moisture of the filter paper might absorb some SO_2, thus giving high results. Tests were made by passing pure SO_2, free from SO_3, through the apparatus and it was found that if sufficient air was drawn through after the gas, all SO_2 was expelled from the filter, which would then give no trace of acidity.

During some experiments it was found while using a dry filter paper, that when considerable amounts of H_2SO_4 were caught and allowed to stand for some time, the strong acid would slowly attack the paper with mutual decomposition. When this occurred the acidity would always be too low.

In practice it is found that when using a damp filter which is put in water, soon after use, any amount of SO_3 likely to be found in flue gas would not be great enough to cause this disturbance.

After a rather thorough trial of this method I consider it satisfactory. It is simple, results are quickly obtained, and I have found them to be more uniform than those obtained by any other method.

Magnetic Dressing of Tin Ores

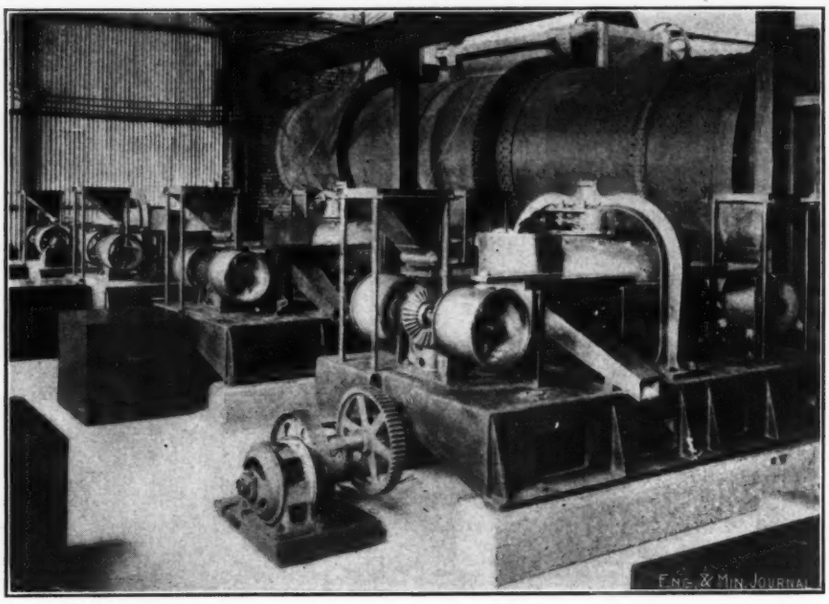
By J. B. Van Brussel*

The complex tin ores of Cornwall, England, have for many years been dressed for tin by methods which are crude, but have been tenaciously adhered to and the average Cornishman is so wedded to these primitive methods as to be fully convinced that there is nothing in the world to equal them.

The accompanying illustrations show the essentials of a mill which is a radical departure from the Cornish method of dressing Cornish tin ores. In a comparison of the two methods it may be well to state what the old method is.

In Old Method Stamps and Tables were Used

The ore, as it comes from the mine is stamped in a battery, either of the California or of the pneumatic type. The pulp from the battery is run to tables of different types, the Wilfley being largely used. The rough concentrates from these tables, which contain all of the complex minerals of the ore, tin, copper, wolfram and pyrrhotite, are known locally as "whitts." The whitts are roasted for the elimination of arsenic and sulphur, the arsenic being caught in suitable chambers. The iron on being changed into an oxide swells so that its specific gravity is lessened. In the second washing, to which the material is now subjected, the iron is washed out, the tin in the form of cassiterite not having been changed by this roasting. Any copper in the whitts has been made soluble by the roasting, and is washed out. Frequently this wash water is run over scrap iron and a portion of the copper recovered as cement copper. In the fine crushing required to liberate the various minerals, much of the tin is slimed, and good Cornish practice does not recover over 65%. The above condition of affairs has led to extensive research, the magnetic separation plant at Loughborough, England, being the result of investigations in the dressing of these ores.



Magnetic Separators at Loughborough Mill, England

New Mill Uses Rolls and Magnetic Separators

The Loughborough mill is terraced on a hillside. The crude ore, as mined, is crushed in an ordinary rock breaker which is followed by a screen. Since 15% of the ore from the rock breaker is 30-mesh material, it is removed to prevent sliming, as well as to avoid rehandling material that is fine enough. The oversize from the first screen is fed to a pair of high-speed, heavy-steel rolls, set ¼ in. apart. These rolls are 44 in. in diameter with a 6-in. face, making 200 r.p.m. and crush 10 tons per hour. Of the product of this crushing 45% will pass a 30-mesh screen. The oversize from this screening is fed to a second pair of rolls of the same description, but set close. The roll product is combined with the undersize from the screening operations and fed to a gas-

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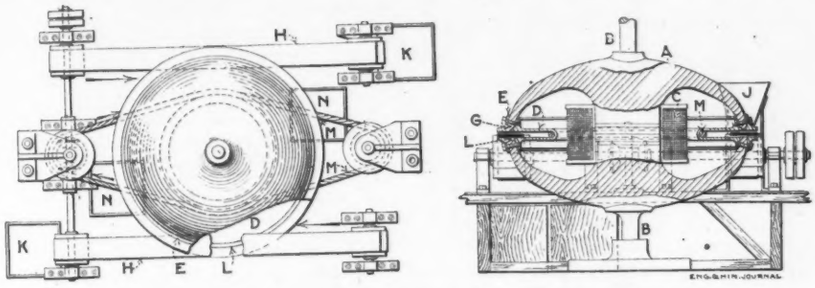
fired furnace. The object of this roasting is to give a flash roast making the minerals magnetic. The cooled ore is then fed to magnetic separators or concentrators; the magnetic flux is so great that all material containing the least trace of iron is withdrawn.

The mode of operation of the apparatus is indicated in the accompanying engraving. The double mushroom magnet *A* is mounted on a vertical spindle *B*, running in suitable bearings, and has a central core, around which is wound the exciting coil *C*. The magnetic field is used in the gap at the periphery, the upper pole-piece *G* being beveled to concentrate the field, while the lower pole-piece *L* is left flat. A channel *D* of non-magnetic material is secured by flanges to the inside of the pole-pieces, and annular brackets *E* of the same material are bolted to the outside. By means of the belts *H*, the crushed ore is conveyed between the pole-pieces; the magnetic particles are attracted and adhere to the upper pole-piece, whence they are swept off by the rope *M*, which is driven faster than the mushroom magnet. The magnetic particles fall into a receptacle



MAGNETIC SEPARATORS FOR TREATING COMPLEX TIN ORES

N, while the unattracted particles are carried away by the belts and fall into the receptacles *K*.

Everything of value, with the exception of about half the tin which is in the form of pure cassiterite, is saved in these machines. The tailing or residue from this magnetic concentration is clean rock and cassiterite, which are fed to Cornish buddles, where the quartz is washed away. By this method of working the recoveries rise from 65% to 95 per cent.

WOLFRAMITE REMOVED MAGNETICALLY

Many of these ores also carry wolframite, which is the ore of the tungsten. Wolframite has practically the same specific gravity as cassiterite and in ordinary water dressing goes with it. In this magnetic concentration the wolframite is withdrawn by the magnet. This magnetic concentrate may be subsequently treated by magnetic separation, using different magnet strengths, the most weakly magnetic minerals being brought out last and the most strongly magnetic materials first. The magnetic concentrates freed from wolframite are roasted to drive off arsenic and are then smelted for an alloy of tin and copper which results in what may be properly called a virgin bronze.

All of the expense of separating the tin and copper, as well as the attendant loss of each in the separation are thus avoided. Much of the tin and copper of the world's markets is used by founders, in making alloys of these metals. It is therefore the height of folly to throw away a large proportion of the economic metals occurring in these ores to effect their separation, when they are recombined by the founder in his alloy. It has been the object of this work therefore to make large savings of the individual metals by never separating them at all and carrying the smelting out in such a way that a finished alloy acceptable to commerce is produced. It may be well to speak of the individual units of the plant in the order of their use.

REVOLVING GRIZZLIES USED

The screens, having to handle a large tonnage of heavy coarse material and yet withdraw only the portions fine enough to pass a 30-mesh screen, were designed in the shape of what may be called a ring grizzly; the component parts of the screen are made up of hard rings of V-section with point of the V outwards. A number of these rings assembled in a frame with distance pieces between, makes the screen. These screens handle a large tonnage of coarse material, removing the fines with practically no wear.

The rolls are also worthy of attention. They are of the high-speed, narrow-tread type, with heavy steel shafts running in self-oiling reversible bearings. The main feature of the rolls, however, is in their truing device. Such rolls, if not kept absolutely true, are a source of great annoyance and do poor work. At each end of the machine is a table planed true with each roll shaft. On this table is a motor-driven emery wheel which keeps the rolls ground true. The bearings are self-oiling with large oil cellars and dust covers. All of the machines are individually motor-driven; in the case of the rolls, two motors are run in opposite directions so as to avoid a crossed belt.

The outfit, grinding 10 tons per hour, consumed 60 kw. A plant, treating identically the same rock with 40 California stamps weighing 1050 lb. each, had a capacity of five tons per hour and consumed 86 kw. A comparison of the two methods of crushing is thus afforded.

The Michigan Gold Mine

ISHPEMING CORRESPONDENCE

The Michigan Quartz Silica Co., of Milwaukee, has finally granted a year's option on 40 acres of its holdings at the old Michigan gold mine, five miles northwest of Ishpeming, to Morgan Jopling and Morgan Wright, of Marquette. Mr. Wright will be in charge of the exploration work during the year, and has already commenced preparations.

The Michigan gold mine has produced about $18,000 in gold, most of this in 1890, when there was a lively trading in its shares. When gold was first discovered the surface showing was rich, and incidentially "high-grading" among the miners became a profitable business. A few feet below the surface the rich oreshoot gave out and the quartz vein became barren; a little deeper, smaller oreshoots were encountered, and a small mill was erected. With two shafts less than 90 ft. deep work was abandoned, due to the low grade of the ore and lack of interest.

Beside the main vein, there are several others, all in Keewatin schist; the veins strike nearly east and west. In many respects the geological features are similar to those of the Porcupine district of Ontario.

Swedish 1911 Mineral Output

The official report of the Swedish mineral output for 1911 shows the following: Iron ore, 6,153,778 metric tons; zinc ore, 51,242; silver-lead ore, 2999; iron pyrites, 30,096; manganese ore, 5377; copper ore, 1623 metric tons. Of the iron ore produced, 4,094,581 metric tons carried between 60 and 70% of Fe, and 1,270,566 tons more carried between 50 and 60% Fe.

The metal production, excluding iron, was: Copper (including production from imported ore), 3221 metric tons; zinc, 2124; lead, 1134 metric tons; silver, 1289 kg.; gold, 11 kg. Other products and byproducts of the mineral industry were: Zinc sulphide, 37,537 metric tons; feldspar, 36,235; quartz, 24,927; copper sulphate, 320; alum, 159; ferrous sulphate, 156; graphite, 65; powdered pyrolusite, 56 metric tons. All figures are arranged in order of descending value.

Determination of Oxygen in Iron and Steel

The importance of oxides in determining the chemical and physical properties of iron and steel was brought out by Ledebur in 1882. His method for the determination of the combined oxygen consists in reduction at a red heat by hydrogen, but as this method does not attack the oxides of manganese, aluminum, silicon, titanium, etc., it is obvious that the method is not a satisfactory one.

At the Eighth International Congress of Applied Chemistry, William H. Walker and Walter A. Patrick described a method for determining oxygen in iron and steel by converting all the oxides into the corresponding carbides by heating in an electric furnace with an excess of carbon. The oxygen is evolved as carbon monoxide, which is then determined, the deoxidized metal being converted to carbide.

A vacuum furnace of the Arsem type, as supplied by the General Electric Co., is used, shown in Fig.1. The gun-metal chamber *A*, of the furnace of 20 capacity, rests inside the water-jacket *R*. The cover *B* is fastened to the chamber by means of 18 capscrews *D*, and the joint is made tight by a rigid lead gasket. The tube *J*, through which the air is exhausted, is soldered into the cover.

The window tube *G* is fastened to the cover by six capscrews, the joint made tight by another lead washer. The mica window *E* is placed in the top of the window tube. Current is led in by the electrodes *W*, which are brass tubes containing running water. The graphite heater *L* is fastened to the electrodes, by means of the clamps *U*. The crucible is supported by the stand as shown in the illustration, and is thus placed in the hottest part of the furnace.

Twenty to 25 grams of the sample are placed in a small graphite crucible, and four or five grams of finely powdered graphite added. The crucible is then placed in the furnace and by means of a small rotary oil pump operated in series with a Geryk pump, a vacuum of 0.01 mm. is obtained in less than 15 min. After exhausting the furnace, the cooling water is turned on and crucible and contents heated to about 500° to 600° with the pump still running.

This is done to pull away the oxygen absorbed by heater and crucible as completely as possible. As carbon does not begin to reduce these oxides below 900°, there is no danger in this heating. After 15 min. the furnace is allowed to cool, and nitrogen, which has been pumped over sulphuric acid and phosphorous pentoxide, is allowed to fill the furnace half full. This is then pumped out and the furnace again heated gently. It seems impossible to pump the absorbed oxygen completely out of the furnace, but by washing with dry nitrogen, it can be almost eliminated.

The stopcock leading to the pump is now turned off and 70 volts applied to the electrodes, which causes a current of about 200 amp. to flow through the heater. The metal melts in three or four minutes, and just as it melts violent ebullition often occurs. This is checked by opening the circuit for a few minutes, then after the metal becomes quiet, heat for 20 min. The furnace is allowed to cool thoroughly, and is then completely filled with air, or better, pure nitrogen which has been passed over sulphuric acid and phosphorus pentoxide.

Analysis for Carbon Monoxide

The vessel *C*, in Fig. 2, is exhausted by means of a Toepler pump, and connections made with the furnace as shown in the diagram. The stopcock from the furnace is opened and if the gas in the furnace is under a pressure other than atmospheric, the pressure is shown by the differential gage *E*. From this the pressure inside the furnace can be calculated. Stopcock *F* is now opened and the vessel and pump filled with gas. A decrease in pressure corresponding to the volume of gas taken from the furnace, is then shown by gage *E*, and we can thus calculate the fraction of gas taken from the furnace.

The gas is then forced slowly over iodine pentoxide heated to 130° C., which oxidizes CO to CO_2 liberating an equivalent quantity of iodine. The latter is absorbed in 10% potassium-iodide solution, and subsequently titrated with $\frac{N}{10}$ sodium thiosulphate.

The accuracy of the method was tested in various ways, given at length in the original paper. It is also noted that the decomposition of iodine pentoxide is at a minimum at 130° C. while it will still oxidize CO, but at 150° C., iodine pentoxide will give up considerable amounts of iodine in a current of air or nitrogen.

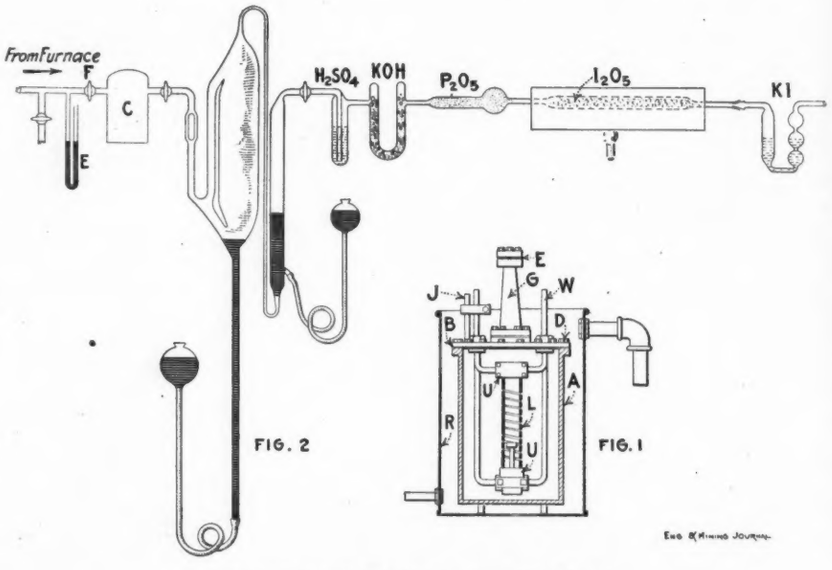


FIG. 2 FIG. 1

Determining Oxides in Iron of Steel

Siberian Lead-Zinc Deposits

The richest deposits of zinc and lead ore in Siberia and all the Far East are found in the Oglensky mines, near the town of Vladivostock, on the course of the River Tyutyuche, 20 miles from the Gulf of St. Vladimir, with which gulf they are connected by a narrow-gage railway (*Min. Journ.*, Oct. 29, 1912). This ore contains 22.19% of lead, 18.90% of zinc, 27.49% of iron, 28.38% of sulphur, and 160 grams per ton of silver. There is a similar mine in the Soadnsky property of the Caucasus, in the Vladikavkaz district. The ore there contains 18% of zinc, 5% of lead and 110 grams of silver per ton. All the ore produced at the Olgensky mines is shipped in a crude state, by way of the Pacific Ocean, to Germany. At present the government desires to impose a high export duty on this ore, and the German company which owns the property is constructing, near the mines, reduction works, which will be the first on the Pacific. Other similar mines in this district are near a place called Stolboff, in the Gulf of Preobrazhenie, and again in the valley of the River Uan-Chan, about 14 miles from the sea, and also further north of the Gulf of St. Vladimir, near the village of Tazome.

Compressing Natural Gas

Compression is used to increase the capacity of natural-gas pipe lines; slow-speed steam engines preferable for this service. Certain natural gases give highly volatile liquid byproducts, which can be used to enrich gasolines, or sold as liquefied gases.

*Abstract of a paper in the Proc. Eng. Soc. of Western Pennsylvania, June, 1912, by E. D. Leland, superintendent of compressing stations, Philadelphia Co., Pittsburgh, Penn.

The original paper under this title was devoted mainly to the design of the power plants employed for expediting the delivery of natural gas from producing fields to consuming centers. The author's conclusions on this subject may be briefly summarized before referring to the occurence and character of the gas itself.

Compression Used to Increase Pipe Line Capacity

The average original rock pressures in the gas fields, 825 lb. per sq.in., in Pennsylvania; 450 lb., in Ohio; 326 lb., in Indiana; 1000 lb., in West Virginia; and 400 lb., in Kansas, have diminished greatly, in some cases to less than atmospheric pressure. On the other hand, consumption has increased enormously. To conduct the required output through long pipe lines of reasonable diameter, it is now customary to compress the gas near the point of production, and sometimes also at relay stations along the line. For example, a 16-in. line 100 miles long, with an initial pressure of 100 lb., and a terminal pressure of 10 lb., would carry about 12,700,000 cu.ft. per 24 hours; raising the initial pressure to 350 lb., would increase the delivery to 41,300,000 cu.ft. Exhaust pumps at the delivery ends of pipe lines have not been found satisfactory.

Gas compressors for this service are practically identical with air compressors, but are designed to operate at higher pressures, and with a medium containing more or less grit. The desirable features of such a compressor are: A long stroke and slow rotation, together involving a piston speed of not over 650 ft. per min.; conical cylinder heads; solid, one-piece, poppet valves with short lifts; removable liners in the compressing cylinders; and adequate piston strength and bearing surface. Water jackets are essential.

For motive power, the cross-compound Corliss engine, direct-connected to the compressing cylinders, is preferred, for the following reasons: (1) Reliability of operation and endurance; (2) ability to start at slow speed; (3) adaptability to the long, slow stroke found most efficient in gas compressing; (4) flexibility and high overload capacity; these are specially desirable features for this work, as the inlet and delivery gas pressures are liable to sudden and violent fluctuations; (5) cheapness compared to a gas engine of equal capacity.

The only serious competitor of the steam engine for this work is the internal-combustion engine, and this the author deprecates on account of its high speed, both while starting, and normally; its inability to handle an overload; its unreliability except under the most skillful management; and the danger introduced by having a combustion engine and an inflammable compressed gas in the same room. The larger sized slow-speed gas engines have been found liable to cracking of the cylinders, due probably to difficulty in jacket circulation, and the present tendency is toward smaller units.

Gas Usually Used for Fuel

For fuel, most of the compressing plants in the country are now using gas, in the ratio of 1 to 5% of the amount delivered. At a modern station in West Virginia, the recent test on a 31x68x60-in. Corliss engine showed a consumption of only 13.36 cu.ft. of gas per i.hp.-hour. Where the market for gas is exceptional, and the compressing plant is near an oil or a coal field, and is on a railroad, the use of these latter fuels is recommended. One ton of Pittsburgh coal, or 180 gal. of Texas petroleum, is about equivalent in heat units to 18,000 cu.ft. of natural gas. The boilers are always situated in a separate building at a distance from the compressors. The cost of erecting a steam-operated plant ranges from $30 to $90 per hp. The operating cost per hp.-hour, ranges from 3.7c. down to 0.71c. in favorable circumstances. The average cost per engine-hour varies from $1.11 to $0.45, depending on the load factor and other conditions.

Further data of this nature were supplied by H. D. Hildebrand, in the discussion following the reading of the paper. Figures are based on 10 plants; five of which were operated by steam and five by gas engines; the average rated capacity of the 10 was 4500 hp.; units of 1300 hp. were generally adopted. Half of the plants were situated on railroads and the other half in remote districts. The average initial cost, including sites and dwellings, was $56.33 per rated horsepower. The operating cost per rated horsepower-year included: Oils, grease, water, packing, etc., $0.62; labor, $1.95; repairs and upkeep, $1.33; total, $3.90, exclusive of fuel, which was gas, of which 23 cu.ft. was required per hp.-hour, costing 2½ to 10c. per cubic foot.

Profitable to Pump from Low-pressure Wells

The question is often raised as to whether it is profitable to pump gas when the intake pressure is below that of the atmosphere. This depends upon the size of the pool and the porosity of the rock; with a good-sized pool, and an open rock it is profitable to pump against even a high vacuum. In the Indiana field, some of the large compressing stations operated profitably for years with an intake pressure four or five pounds below atmosphere, while at some stations a vacuum of eight or nine pounds was not unusual. Operation under these conditions was strenuously opposed by the oil companies of the district. In the Pennsylvania and Kansas fields many pools are being pumped at rock pressures below one atmosphere.

Gas from the wells contains a quantity of vapor, oil vapor from the vicinity of an oil pool, or water vapor if from contact with salt water. Compression and cooling of the gas reduces its vapor carrying capacity, and oil or water is thereby deposited in the pipe lines. In a hilly country, these liquids are readily drained from the lines by suitable drips placed at low points, but in a flat country like Indiana the problem of keeping long pipe lines free from liquid is a serious one. During the period of greatest production in the Indiana gas fields this task was successfully accomplished by first cooling the gas from the compressors in a large cooling pond, then conducting it slowly through large pipes, in order to give it time to drop most of its moisture. This cool and partially dry gas then passed through a dehyrating system, expanding ammonia still further reduced the temperature and more liquid was thrown down.

The idea was to reduce the gas to the lowest temperature while it was under the highest pressure, and the result was a practically dry gas for transportation.

As the Indiana natural gas was about 94% marsh gas, which liquefies at 2700 lb. per sq.in. and 12 deg. F., there was no danger of liquefying the gas under the dehydrating treatment. But this practice resulted in what was probably one of the earliest experiences in recovering gasoline from natural gas. For, in 1902, at one of the Indiana stations which was

compressing gas from near an oil pool, we obtained from the drips of the cooling system an average of 80 bbl. of gasoline each day. Most of the natural gas found in the large gas fields in this country contains from 83 to 99% methane, and a small per cent. of ethane; it has a specific gravity about six-tenths that of air, and a heating value of from 1100 to 1200 B.t.u.

This is sometimes called a "dry gas" and is the kind we usually have in mind when discussing gas compression. But in recent years an industry has sprung up which compresses and liquefies the gases or oil vapors drawn from oil wells. These "wet gases", of greater specific gravity and higher heat values, contain large percentages of propane, butane, and other hydro-carbon vapors which, when under pressures of from 600 lb. down, liquefy at ordinary temperatures. This briefly is the work of the so called natural-gas-gasoline industry, and the failure to recognize the difference in the composition of the two types of gases has led to some unfortunate investments in gasoline-recovery plants.

Carbon Monoxide and Hydrogen Lacking in Natural Gas

In the discussion following the reading of the paper, G. A. Burrell gave some interesting results of recent investigations conducted by the Bureau of Mines. Some natural gases contain methane as the only hydrocarbon, and these are distinctly "dry gases;" the same name is applied to natural gases in which methane predominates, but is accompanied by small amounts of ethane and still smaller traces of the higher paraffin hydrocarbons. The "wet gases" are those commonly found in the oil fields, and contain commercial quantities of easily liquefiable hydrocarbons. The line of distinction is not sharply drawn. In the natural gas of Pittsburgh, the hydrocarbons consist of about 84% methane and 15% ethane. Carbon dioxide is present to the extent of about 0.03% and the balance is nitrogen. The specific gravity of the gas is about 0.64 and the heating value about 1100 B.t.u. per cu.ft., at 0 deg., and 760 mm. pressure.

The other natural gases of the Appalachian region appear to be of a slightly higher heating value than the Western gases. Carbon dioxide is usually present in very small quantity. Contrary to the usual information, oxygen, carbon monoxide, hydrogen and olefine hydrocarbons have not been detected in the natural gases thus far examined.

Regarding the wet gases, we find that some of them contain enough of the higher paraffin hydrocarbons that gasoline extraction therefrom is a profitable industry. Many plants are producing three or four gallons of gasoline per 1000 cu.ft. of gas. In some cases this production is exceeded. These figures refer to the gasoline actually sold. The condensate received in the storage tank may be more than this, but so volatile are some fractions that they volatilize upon exposure to normal temperatures and pressures.

Separation of Less Volatile Hydrocarbons

Further details as to the manufacture of the new "Gasol" were given by Dr. W. O. Snelling. The process consists essentially in the preliminary condensation of "wet" gas, such as oil-well gas; the separation of gasoline from this first condensate, followed by the further separation of the lighter hydrocarbons, with the exception of methane, by a system of rectification. This consists essentially in volatilizing all of the hydrocarbons present under pressure of about 1000 lb. per sq.in., and then condensing upon heated coils certain fractions of the material thus volatilized, the condensation being selective, and based upon the difference in critical temperature of the gases present. It is a well known physical fact that for each gas there is a certain temperature above which pressure, no matter how great, will fail to reduce the material to a liquid condition. By taking a number of gases and passing them, under high pressure, past coils which are heated to a temperature higher than the critical temperature of certain of the gases present, but lower than the critical temperature of others, it becomes possible to prepare pure fractions of the hydrocarbons.

"Gasol" is a colorless and transparent liquid, which can be conveniently transported in steel bottles, and which upon release of pressure forms a pure gas of homogeneous nature and high heating power. Under pressures of more than 400 lb. per sq.in., the material is liquid at ordinary temperatures, but at any pressure less than 400 lb. it is resolved into gas. The calorific power of the gas is 2400 B.t.u. per cu.ft., and has therefore about four times the heating power of coal gas, and somewhat twice the heating power of ordinary natural gas.

International Atomic Weights, 1913

In the Journal of Jan. 13, 1912, appears the table of the accepted International Atomic Weights for 1912. The 1913 report of the International Committee, F. W. Clarke, T. E. Thorpe, W. Ostwald and G. Urbain, has now appeared (*Journ. Am. Chem. Soc.*, Nov., 1912), in which it is announced that there is only one change in the table, as previously published in the Journal, the inclusion of holmium (Ho), 163.5. This makes 83 recognized elements.

The Badirahuato District, Sinaloa, Mexico

By G. L. Sheldon*

The Badirahuato district is in the State of Sinaloa, Mexico. It is due north of the Culiacan district and extends eastward to the state lines of Chihuahua and Durango. The town of Badirahuato is 45 miles by wagon road from Retes, a station on the Southern Pacific of Mexico R. R., or it may be reached from Culiacan, by the old San Fernando wagon road to Las Higueras, thence by trail to Badirahuato, a total distance of about 50 miles. It may also be reached via Mocorito from Guamuchil on the Southern Pacific. The town of Badirahuato has a population of about 2000 and is situated on the river of the same name.

In the vicinity of the town there are large lava flows and no veins are known. There are placer deposits in several places in the district but the greater number of claims are for vein mines; although silver is the principal mineral, gold, copper, lead and zinc ores are found in the veins, many of which have been extensively mined in a desultory manner near the surface. The ores as a rule are heavy sulphides but in many of the veins there is sufficient free gold or easily recovered silver to permit a profitable recovery of these metals by the crude methods within the command of the native miners. No large company is operating in the district and although no one vein is systematically mined, the small shipments occasionally made from the many veins amount to a fair total. Mining on a small scale has been going on for many years so that the total value of the ore shipped to Culiacan, especially silver ore, represents no small amount of money.

High Grade Ore All Removed

In nearly every instance all except the low-grade ores have been removed from the numerous small adits and shafts that have been driven or sunk on the vein by the *gambucinos*, who seem to have developed great skill in following pay ore.

At Carrizal, a few miles northeast of Badirahuato and on the north side of Naranjos Arroyo, is a small gold-placer area, the depth to the bedrock being from 10 to 20 ft., of which a foot or two is pay gravel, and worked by the natives in a small way with fair results. Upon Guajalote Mountain, a few miles northwest of Carrizal, is the Guajalote mine worked 12 or 15 years ago by a Mr.

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Dickerson. After developing a quantity of gold ore, carrying pyrite, he bought a mill, but he was killed at a dance while the mill was being brought in and the mine has since caved and is idle. To the north is the Last Chance gold and silver mine of Ysebel Serrano, and near it some locations have been made by Enos Jennings.

At Los Naranjos, a few miles above, Serrano sold the Jesus Maria prospect about four years ago to Atenacio Rocha of Copalquin, Durango. A half-mile east of the Jesus Maria, on a limestone and granite contact, a large gold vein, 40 to 50 ft. wide, was discovered last year. On the side hill and flat below this discovery, the ground was placered with good results years ago. Below, at the junction of the arroyo with that of Los Naranjos, a German took out several thousand dollars in gold a number of years ago. On the right-hand side of the creek, a mile above the Serrano house, is the Bueno Suerte prospect which contains a large vein of gold-silver-zinc ore at the granite contact.

Silver Mines at Santiago de los Caballeros

On the same arroyo, 12 miles northeast of Naranjos, is the old town of Santiago de los Caballeros, where are several old silver mines. Los Tajos, an old property, has been well developed by James Fitzgerald and J. B. Shepherd of Denver; a cyanide plant has been under contemplation for some time. The vein is a narrow one and besides its silver contents carries a little gold, some zinc and pyrite. Three miles south of Los Tajos mine is the Concepcion, worked 20 years ago by Spanish owners who ran two long adits on the vein and treated the ore on the ground. In a dispute over surveying the property, one of the owners was killed and it has since been idle. The vein can be traced for a long distance to the east in the andesite. Three miles south but higher in the mountains, Luis Fonseca has a gold prospect, also in andesite.

At Santiago, Pedro Palacio, a Spaniard, runs a good country store which is a convenient place for outfitting. Three miles west of Santiago, J. B. Shepherd developed the Mina Grande. It has a large silver-lead vein, but the value of the ore is too low to warrant operations without concentration. On the divide to the north and east of Santiago is the Puertocitos mine, which has been operated with good results.

Silver and Copper Near Alisos

Near Alisos, five miles west of Santiago, there are several silver and copper prospects on the arroyo. To the north three miles is La Plata mine, worked 10 or 15 years ago for silver, but now idle. A short distance above and across the arroyo is the Rosendeña mine owned by J. D. Murray; this was worked 20 years ago. The ore was high in silver and the gold occasionally ran as high as three or four ounces. The mine is wet and caved at present. This and the La Plata are both in the porphyry and it may be that they are working the same vein, but faulted. The Rosarita silver mine about one mile east, at Nogales, was worked 10 or 15 years ago, and more recently two Englishmen secured a lease, but after taking out some good ore they got into litigation with the owners and quit.

At Portreo de Tepaca, J. Johnson owns the Concepcion mine, formerly worked by the Spaniards. This is in limestone about 400 ft. above the granite and was developed by five adit levels. The ore contains gold and silver, but on account of the pyrite content, the owners were compelled to roast and treat the ore on the ground. From the old Trinidad mine, on the opposite side of the arroyo, a *gambucino* last year took out two *cargas* (600 lb.), which had 500 oz. of silver in it. Farther west on the same creek is the old Manta mine, with a good record for silver production. There are several other prospects in this vicinity with more or less development and from which some small shipments of good ore have been made; native silver was found in one instance.

The Crawford Silver Mine

On the Tamapa arroyo, a few miles below the town of Tamapa, is the San Roque mine, worked 12 to 20 years ago, from which much silver-lead ore was shipped to Culiacan. The mine is close to the arroyo and has been idle for some years, due to flooding. About 10 miles below on this creek Juan Crawford has a silver mine, from which he has taken much good ore from time to time during the last ten years, probably the largest production of any one mine in the district during this time. He shipped to Culiacan and has been fortunate in selling the mine twice and in receiving substantial payments down each time, but the mine has reverted to him on account of the purchasers not being able to complete payment.

Two or three miles below the town of Ocotios, on the same arroyo, near its junction with the Humaya River, is the San Jose del Oro mine, on a small hill, from the surface of which the natives have dug out numerous small pockets containing free gold. J. B. Shepherd acquired it several years ago and drove a tunnel near the base of the hill, but here the ore was low grade and contained much pyrite. A small arroyo comes in from the west and three miles above is the Terreo vein, 100 to 200 ft. wide. The vein crosses the creek, making a dam there and permanent water for a few families that live at this place. On the west side of the creek, 50 ft. above, there are thousands of tons of broken material. It must have been sorted for the rich ores, as occasionally a little free gold can be seen, although as a whole too low grade to ship. Possibly it could be cyanided. About 1200 ft. from the creek, at the contact with the granite, there has been considerable work done and some good pockets of free-gold ore removed. Two or three miles above there is little placer gold in the arroyo, which was located by Los Angeles men two years ago. Above Tula, about five miles east of Tamapa, the arroyo is rather flat and contains some placer ground where the natives sink to the bedrock nearly every year 10 to 20 ft. and obtain some gold. Over a small divide two miles south of Tula is a small village known as Placeras, near which some placer ground has been found in the arroyo.

A mile east of Portreo de Spaices is Alisitos, a small silver-lead camp where an American, M. Root, worked for a number of years, first operating the San Manuel, which he afterwards sold to the West Coast Mining & Smelting Co. Later he located the extension of the San Manuel on the north, and this proved even better than the San Manuel. Finally he sold to a former partner, a Mr. Ellic, of Oakland, Calif., who worked the mine in a small way for several years, but was waylaid and killed last year while returning from Santiago with his payroll money. Why will Americans continue to pack their payroll money, when it is an easy matter to get an entirely trustworthy Mexican to do it for a few pesos? And, why travel without a mozo?

The San Luis de Gonzaga Mine

About 25 miles east of Tamapa is La Tuna, and five miles farther east is the San Luis de Gonzaga in one of the best mineralized sections in the state. Some of the ores are pyritic in character, and one large vein 10 to 20 ft. wide can be seen on the surface for five miles. At one place where considerable work was done it shows gold, silver, lead, zinc, antimony, a little copper, and much pyrite. J. T. Canfield, of Culiacan, worked it 12 or 15 years ago for silver, obtaining some high-grade though refractory ore. He ran a long crosscut adit and cut the vein in a barren place and was compelled to quit for lack of funds. He still owns the Trinidad mine, a short distance north.

The Tres Reyes mine, a few hundred feet to the west, has half a dozen openings, including a long tunnel and inclined shaft on the vein, which dips into the hill at about 30°. The property contains gold and silver ore in a hard quartzite about 200 ft. above the granite,

with a production of upward of $100,000 during recent years. Above the Tres Reyes are two or three parallel veins and crosscutting them all is a six-foot vertical vein carrying gold and silver. All of these five veins could be developed by an adit on the vertical one.

About a mile to the south is the Rosario gold mine, with several hundred feet of work done at various periods in the last 10 years. Three or four miles above is the San Luis de Gonzaga, on which there is an old 10-stamp mill. This property made a large production since 1875. About six years ago it was bonded for $400,000 by some Americans who started a long crosscut tunnel but failed to complete it.

A few miles south, the three states, Sinaloa, Chihuahua and Durango, corner in the mountains at an altitude of about 7000 ft. In this section are several prospects; one a 20-ft. silver vein carrying a little copper; another is an iron gossan carrying silver and copper; a third is a 150-ft. quartz outcrop that extends down the mountain from an altitude of 7000 ft. to an elevation of about 3500 ft.; it runs from a trace to $5 in gold and up to 16 oz. in silver. All these can be located, but they are 100 miles from the railroad. In this section are some narrow high-grade silver veins in limestone, on which a little work has been done, some rich pockets having been taken out a few years since.

In the Sierra Monterey, 10 miles north of Tamapa, M. Root owns a 20-ft. copper vein and at another place narrow streaks of copper glance can be seen on the surface for a distance of 1000 ft. On the east side of the mountain, Florentino Flores, of Tamapa, owns the Gausamer silver mine which has produced some rich silver ore and has been worked recently. The Copalitos mines, about 20 miles north of Tamapa, were worked for many years, five different haciendas having been erected and operated from 1850 to 1892. There are six veins, from 10 to 60 ft. wide, and on account of their great width were only worked to a depth of about 60 ft. The ore carried silver sulphide and a little gold, and is an excellent ore for cyaniding. The Sinaloa River is less than two miles distant and could supply power for a large operation, which will doubtless be undertaken some day.

Trigo Ore Was Roasted and Lixiviated

About 20 miles north of Copalitos, is the San Javier mine worked by the Martinez de Castro brothers for 12 years. They treated about 24,000 tons, crushing dry in a 10-stamp mill, then roasting and lixiviating. Northwest of the San Javier about 20 miles is the Trigo, worked by an English company for about 20 years. The ore was ground and roasted and lixiviated and though a large production was made the company never paid a dividend. Roads were built over the mountains for hauling wood and a generally expensive management prevailed. At a depth of about 600 ft. the silver content became lower and about this time the company purchased the San Jose de Gracia gold mine, and abandoned Trigo. Within the last two years, the tailings dump was purchased by Ziegler brothers who undertook the erection of a cyanide plant.

As a whole, the district has had little development. Except the Trigo, no strong company has operated there, but it is evident from the numerous shipments of good ore that the district contains many prospects worthy of development.

Santa Gertrudis Co., Ltd.

The gross earnings of the Santa Gertrudis Co., Ltd., for the 12 months ended June 1, 1912, were £631,432, the operating expenses £355,934, and net earnings from operations £275,498. To this must be added £1150 for miscellaneous revenue, making the net surplus £276,648, from which £24,227 was deducted for depreciation, leaving a net profit of £252,421. Out of this on June 28, 1912, a dividend of 15 per cent. (three shillings per share) amounting to £205,200, was declared.

In order to simplify matters connected with the mines and mills under existing contracts, two companies have been formed in Mexico, one to operate the mines and the other to treat the ores, the whole of the capital of both of these companies being owned by the San Gertrudis Co., Limited.

A total of 16,249 ft. was driven, raised or sunk in the various workings. The ore reserves as at June 30, 1912, are estimated at 586,000 tons of positive and partly developed ore, estimated to yield a profit of £899,590, and 551,000 tons of probable ore, estimated to yield a profit of £632,170.

The new mill started operations on June 14, 1911. The plant was originally designed to handle 600 metric tons per day, but to meet the increased production from the mine it was decided to enlarge the capacity to about 850 tons per day. This new section will be ready for service in November, 1912.

In the period under review 269,839 dry tons of ore and tailings were treated, with a gross value of £714,047, or £2 12s. 11d. per ton. There was recovered in bullion 88.43 per cent., or £2 6s. 10d. per ton. The bullion contained 26,006 oz. of gold, and 4,420,326 oz. of silver.

Based on operating the entire 60 stamps continuously, the new mill averaged for the last seven months of the year 26.71 days running per month. No interruption to work was experienced locally from the revolution in Mexico, conditions in Pachuca and throughout Hidalgo being reported in a satisfactory state.

Mineral Resources of Colombia*

Colombia is not a poor man's mining country. A prospector without capital or backing stands little show, largely because of the lack of transportation facilities, the rugged character of the country, the climate, and the difficulty of securing supplies and food except at high prices. Moreover, no quantity of "panning" or "rocker" ground is to be found from which the prospector can recoup his fortunes, writes U. S. Consul, I. A. Manning, of Barranquilla.

Scientific prospecting alone will succeed in Colombia. Few profitable lodes have been discovered, and they are frequently much disturbed or contain horses of barren rock. That there are numerous deposits yet awaiting discovery cannot be doubted, but as a general thing these will be found, if placer, to carry such an overburden of surface material as to require machinery for satisfactory prospecting or development; if quartz, to be of low grade and, in the main, to carry refractory ores.

Copper Deposits of Great Variety

In a recently published article Ricardo Lleras Codazzi, professor of mineralogy and geology in the University of Bogota, says that the deposits of copper in Colombia are of great variety. Natagaima is celebrated for its copper deposits and also produces considerable quantities of gold. This mineral zone reaches from Ataco to the *paramo* of Dolores, crossing the Magdalena River. The plains of Tolima extend from Nevia on the south to Honda on the north. In the mineral region one may see the different strata of Cretaceous rock, broken and dislocated by intrusions of eruptive rock. Contact metamorphism is marked in some places, especially in Natagaima and Nanurco.

In Ataco the rock is like that of Natagaima, largely diabase, porphyry, and trap. In the Dolores region the copper is associated with zinc and lead. In some parts chalcopyrite is seen in fragments the size of an almond, in a crystalline matrix. In Ibague the copper occurs in lodes in hornblendic and chloritic schists. These mines are worked only for gold and silver, although some veins carry as high as 20% of copper. In Sumapaz, on the eastern slope of the mountain, have been found quartz lodes crossing the schists. This is true also of Quetama.

Ore Occurs in Slates and Sandstone

In the eastern *paramos* of Boyaca the geological formations are similar to those

*Abstract of an article in Daily Consular and Trade Reports, Oct. 31, 1912.

above described and contain ledges of chalcopyrite with quartz gangue. The slates of western Cundinamarca contain numerous lodes with chalcopyrite in a gangue of siderite. In northern Moniquira, aside from the old mines formerly worked by an English company and now completely abandoned, there are strong lodes with chalcopyrite or bornite in quartz. They are in sandstones, which are stratigraphically under the slates and calcareous rocks.

In Bolivar, copper deposits occur in dark Lower Cretaceous limestone, which is eroded into fantastic forms. The ore is in some places only eight inches thick, and appears to occur mainly as a flat-lying deposit at the base of the limestone. This zone is extensive and is found between the crest of the hills and the Valley of Cuevas.

In the mineral region of La Paz and La Guaira, a little farther north, the limestone contains small veins of malachite. In Ocana there is found chalcopyrite, chrysocolla and cuprite. Of similar character are ledges in the mountains of Pamplona. Recently deposits of chalcopyrite have been found in the schists which form the lower spurs of the mountains of Santa Maria.

Garnet, in crystals outwardly dark green but leaving a bright-red nucleus, occurs in the Talco River basin and at the Sapo mine in Tolima, where the crystals have been mistaken for emeralds. The mineral occurs near the contact of granite with limestone and has been formed by contact metamorphism.

Deposits of Iron Ore

Large deposits of iron ore have been found in various parts of Colombia, but the best known deposits are in the district of Upper Cundinamarca. In La Calera, La Pradera, La Caldera and Pacho, iron ore has been found in great masses, running from 52 to 60% iron and the ore in sight has been estimated at 480,000 cu.m. The rock formations are as follows: Fine-grained sandstone, shale, iron ore, and shale overlain by coal and limestone. There is plenty of water power in these regions, and probably these iron ores will at some time attract attention.

Coal has been found in various parts of the republic. In Mustiscuo, Choco, and the *paramo* of Tamar there are said to be abundant deposits of coal of a superior quality. The cannel coal of Tamaita, in Toledo, is of first quality, and in the sandstones there are lodes of graphite. As some of these deposits are found in almost immediate juxtaposition to the iron beds it would seem that at some time in the near future they may be well developed. Coal and even well-defined beds have been found in many places in the lower territory of Colombia, near Rio Hacha, a few miles east of Banco, in the Sinu Valley, and near the Atrato. These seem to be lying awaiting the arrival of capital for their easy development.

Gold Ores Refractory

Most of the gold veins in Colombia are of a refractory nature and can be worked to advantage only with the most modern machinery. It is this complexity of character that has retarded the prospecting of the quartz lodes of Colombia.

The principal gold-mining development of the country is now taking place in the alluvial region. Here, however, the early Spaniard and the miners who followed him for the past four centuries have left little on or near the surface. The result is that almost any gold property in Colombia today depends for success on the expenditure of sufficient capital to establish a dredge, hydraulic process or other mechanical means of working the property. Thus the accuracy of the statement that this is not a poor man's country is evident.

Placer Ground Being Developed

Great areas of land, presumably gold bearing, have been denounced and titles thereto have been applied for during the last three or four years. This has been brought about by the entry of American capital into the field of mineral development in Colombia. Comparatively little of this ground, however, has been prospected in a manner sufficiently scientific to satisfy even the locators that it is pay ground. The capitalists who are financing such projects in Colombia are sending capable, practical engineers with uptodate drilling machinery to prove the land, which they hold under options or which they have purchased. In this manner a minimum amount of money is spent until they have become absolutely satisfied that the ground will pay for the investment of capital on a large scale.

The main gold belt of Colombia lies to the westward of the Magdalena River and above the junction of the Cauca with that stream, and the chief development is taking place in the region lying between the Cauca and the Magdalena and extending as far south as Manizales. This territory can be reached by steamboat and rail for most of the way, but the mining district itself is usually sufficiently distant from the river and railway routes as to require several days of muleback travel.

Petroleum Area Extensive

While the people who have been boring for petroleum at Cartagena and near Barranquilla have not developed oil in paying quantities, widespread interest is being taken in the petroleum deposits. A short time ago I was shown samples of petroleum brought from a spring which gushes from the mountain side not far from Bucaramanga, and I am told that oil signs are found over a great extent of country there. The same is said to be true of the lower Sinu Basin and of the territory near Puerto Cesar and the mouth of the Atrato River, and I am also informed that oil is in evidence on the surface in the district of the Goajira and also near Rio Hacha. The districts where oil has already been discovered are many miles apart and reach the entire length of Colombia. Asphalt is also found not far from the Magdalena River, but too distant from the seashore to have seemed attractive to capitalists as yet.

Federal Mining & Smelting Co.

The report of the Federal Mining & Smelting Co., operating in Idaho, for the fiscal year ended Aug. 31, 1912, shows an operating profit of $858,266, and miscellaneous earnings of $108,676. From these are to be deducted construction and betterments of $98,106, and miscellaneous non-operating expenses of $71,512, leaving a net balance of $797,323, as compared with $1,009,751 for the previous year.

There were mined at all the properties taken together 836,947 wet tons of ore, of which 46,087 were first-class. There were 762,550 dry tons milled. The large increase in first-class ore shipped was due to the doubling of the amount of low-grade first-class sorted at the Morning mine, and to the sorting-plant operations at Wardner.

There were produced during the year 118,734 tons of lead concentrates and shipping ore, averaging 42.9% lead and 20.8 oz. of silver per ton, and 2532 tons of zinc concentrates, averaging 46.93% zinc. Of this total, 40,087 tons were first-class, or shipping ore, which carried from 22.2 to 52.2% lead and averaged 33.7%. The first-class shipped from Wardner averaged 44.9%, from Mace 40.6% lead, and from the Morning 27.7% lead. From the Omaha lease, 1869 tons were shipped, averaging 26.6% lead and 47.7 oz. in silver per ton, not included in the above 46,087 tons first-class from the Federal operations proper. The Omaha lease ore also contained 27,233 lb. copper.

Development work amounted to 18,947 ft. of drifting, raising, sinking and crosscutting. Among interesting changes in the mills may be mentioned substituting Deister slime tables for direct-feed vanners, 8-ft. Hardinge ball mills for grinding, as well as a 7x12-ft. P. & M. tube mill, and 128 more Macquisten tubes at the Morning mill.

Six claims or fractions of claims were bought adjoining the Mace mine from the Idaho Investment Co., all patented, for $180,000, and negotiations are going on to buy, lease, or consolidate with adjoining Green Hill properties.

Total dividends on the preferred stock of $749,131 were paid, and the surplus account stands at $1,324,027, practically all in liquid assets.

American Standard Copper Specifications

In June, 1911, the American Society for Testing Materials issued new proposed standards for copper, which, although they have met with approval by many American users and manufacturers of copper, are, according to Ernest A. Lewis (*Met. and Chem. Eng.*, September, 1912), most unsatisfactory compared with the high-class copper approved by English users.

The American electrolytic refined copper is in his opinion, excellent for high-conductivity wire, and brass alloy, but for wearing properties it is decidedly inferior. To advocate the use and adoption of this exceedingly pure electrolytic copper where a tough arsenical copper is needed is similar to advocating the use of wrought iron for chisels and knives and the disuse of steel. According to Mr. Lewis, it is impossible to work *pure* copper, and the copper as recommended by the American Society for Testing Materials is a nonarsenical copper with just sufficient oxygen in it to enable it to be rolled hot. But such a copper is too soft to be of commercial value from the coppersmith's point of view. If this copper were subjected to a process for hardening it, such as the addition of phosphorus and the removal of oxygen, it would then pass the chemical test, but would fail on electrical.

While the conductivity test is considered of paramount importance in the United States, and is of importance for electrical work, for copper for sheets, tubes, rods or casting ingots, it is, in Mr. Lewis' opinion, valueless and misleading, and what is really wanted is bending, opening, swaying and tensile tests and chemical analyses, limiting certain impurities. None of these tests appear in the American specifications.

The specifications to which Mr. Lewis objects are as follows:

"All wire bars shall have a conductivity of at least 98½% (annealed), and all ingots and ingot bars shall have a conductivity of at least 97½% (annealed) excepting only arsenical copper, which shall have a conductivity of not less than 90% (annealed).

"Of what use is an electrical conductivity test of any kind in arsenical copper? What use is such a test for billets, for tubes, or tubes for rolling into sheets? It would be possible to produce a copper which will pass the conductivity test, but would not be satisfactory for working.

"Again, the standard specification says that the copper content must be at least 99.88%, and to see that the shipment is of good quality it is proposed to take two pieces and drill them, and from the mixed drillings of these pieces the whole shipment is to be rejected or accepted. The best recast electrolytic copper would only just pass the analytical test of 99.88%. As it is absolutely impossible for any refiner to make such recast copper without adding to it 0.08 to 0.1% of oxygen as cuprous oxide, it would be impossible to cast the copper as tough pitch without the oxygen. It would be highly improbable that such copper contained lead, owing to the property which lead has, that in an acid-sulphate solution it separates out as oxide on the anode. But this does not apply to bismuth, and as the tendency of refiners will be to get over-poled rather than tough-pitch copper, in order to pass the analytical test, bismuth might be present in such copper in minute quantity in such a form as to render it unsuitable for making brass alloys for rolling, etc. Why is not the percentage of bismuth limited to 0.005%, and why is not the proportion of oxygen specified?

"Putting on one side the fact that such copper would be too soft in practice for hard wear, it could not be cast from a refinery without oxygen. It is possible to cast billets from crucibles for rolling into tubes with only 0.03% oxygen, by the addition of 0.05% to 0.09% phosphorus, but this variety of copper would not pass the conductivity test, although such copper is excellent from the point of view of hard wear and tear.

"This is an example of an excellent variety of copper, which would pass one test in a specification and fail in another. The only specification given for the arsenical copper is the unnecessary conductivity test. In England the percentage of arsenic is usually specified to be from 0.35 to 0.6%. Many users have found it necessary to limit the lead to 0.1%. In many cases it is essential to have at least double the quantity of arsenic as there is of lead."

In conclusion he states that the American standard specifications are in urgent need of revision for the following reasons:

(1) They do not represent the modern views of metallurgists as shown by recent researches and are not drawn up in accordance with known facts published by practical users and makers of copper.

(2) They put makers of "tough" copper at a great disadvantage, although modern research shows that "tough" arsenical copper is more suitable for making into tubes, rods, and plates (other than electrical work) than the copper recommended.

(3) The methods of rejection or acceptance of parcels of copper by the method of sampling and analysis as described by the specification are unfair to the maker and are against the experience of practical refiners and chemists.

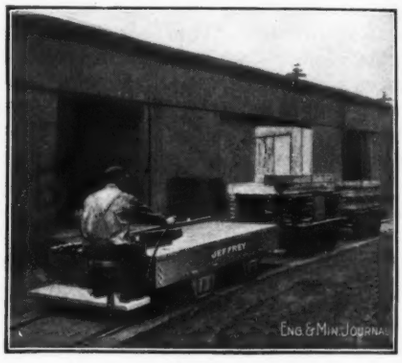
(4) The physical tests are quite inadequate as they contain no reference to tensile strength, elongation or bending tests.

(5) Chemical tests are of no value unless the various impurities likely to be in copper are specified and limited.

(6) Copper which is suitable for one purpose may be quite unsuitable for another purpose, therefore no one specification can cover copper for all purposes.

Jeffrey Storage Battery Truck

A few years ago the Jeffrey Manufacturing Co. designed a storage-battery truck for use in transporting raw material and finished products around its plant in Columbus, Ohio. The trucks proved so successful in facilitating the handling of material and decreasing the cost of this work that the truck was placed on the market. It is now used in industrial plants, lumber yards and smelting works, being well adapted to the service since the truck can haul material on its platform or on separate trucks as a trailing load, as shown in the accompanying illustration. At the Buffalo smelting works a 6-ton locomotive is used



JEFFREY STORAGE BATTERY TRUCK

in hauling train loads of anodes; the truck is also used by the Anaconda Copper Mining Company.

The Jeffrey trucks are equipped with Edison, Exide or other makes of storage batteries as desired. The battery will operate from one to two days on a single charge, depending upon the amount and severity of the service. This truck is so simple in design and rugged in construction that skilled labor is not required and the maintenance and operating costs are correspondingly low.

South Australian Radium

According to the official Review of Mining Operations in South Australit, for the half year ended June 30, 1912, vigorous work is in progress at the Radium Hill mine, near Olary, and 35 men are employed. The ore is concentrated by electromagnetic separators, and the concentrates shipped to Sydney for treatment. It is stated that pure radium bromide has been prepared by the Woolwich works. The work at the Radium Extraction Co.'s

mines at Mount Painter have been disappointing, for no large deposit of ore has been found, only a few small, rich patches of torbernite and autonite.

Colorado Fuel & Iron Co.

This company owns blast furnaces and steel works at Pueblo, Colo.; coal and iron ore mines in Colorado, New Mexico and Utah. The report for the year ended June 30, 1912, shows capital liabilities as follows: Common stock, $34,235,500; preferred stock, $2,000,000; bonded debt, $20,813,000. The total funded debt, including that of subsidiary companies, was $41,188,823 at the close of the year.

The production statement for two years is as follows, in short tons:

	1910–11	1911–12		Changes
Iron ore mined....	841,699	813,728	D.	27,971
Limestone.....	425,704	459,913	I.	34,209
Coal mined.....	4,233,756	4,038,852	D.	194,904
Coke made.....	753,192	777,993	I.	24,801
Pig iron made...	397,701	426,659	I.	28,958
Tin, iron & steel..	424,421	485,743	I.	61,322

Of the coal mined last year, 1,347,469 tons were used in making coke; 672,132 tons were used at the company's plants; 2,019,251 tons were sold. The coal used in making coke was 1.73 tons per ton of coke.

The financial statement for the year is as follows:

	Earnings.	Expenses.	Net
Iron department.	$15,140,523	$12,373,748	$2,766,775
Fuel department.	9,127,929	8,122,423	1,005,506
Total.....	$24,268,452	$20,496,171	$3,772,281
Interest and miscellaneous.....			676,693
Total income.....			$4,448,974
Charges for the year			2,747,746
Balance to profit and loss			$1,701,228

The charges included $226,737 taxes; $2,039,622 interest on bonds; $138,317 sinking funds; $64,104 insurance, sociological work, etc.; $178,965 renewals and other charges; $100,000 dividend on preferred stock. Adding surplus from previous year, the total credit balance of profit and loss was $3,904,061 at the close of the year.

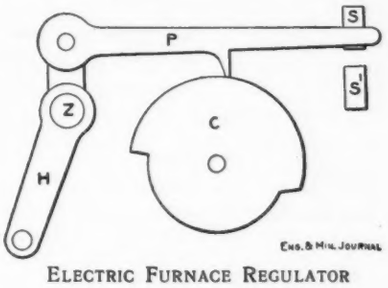
The report says: "The decrease in coal output is accounted for by a falling off in railroad consumption of somewhat more than that tonnage but an increase in general sales. The result in fuel-department earnings was a decrease of $31,092 in gross and an increase of $29,724 in net. As prices of domestic coal were generally lower than in previous years and an advance in miners' wages made effective April, 1912, added at least $20,000 per month to producing cost for three months of the year, the showing in the fuel department is considered particularly favorable.

"There was an increase of 14% in tonnage sales of steel, yet as most of the smaller products, representing about 30% of total output, were sold at generally lower prices than ruled the previous year, there was not a corresponding gain in steel-department earnings, though the ratio of increase in gross was maintained in the net earnings. The year's steel output fairly represents the capacity of the plant, limited as it is by the capacity of the openhearth department of 12 furnaces, and if the increased demand for all kinds of steel products proves to be fairly permanent, authority will be asked in the near future to construct six additional openhearth furnaces to place the company in a position to supply its natural part of that greater demand. Sales of heavy rails already made will take the output of the rail mill for the current fiscal year, and orders for other products now on the books will keep the smaller mills running well into 1913.

"At the special meeting of stockholders, held Oct. 19, 1912, the charter of the company was renewed for 20 years from Oct. 21, 1912, when the previous charter expired.

Controller for Small Electric Furnaces

The plan given herewith was described by Charles B. Thwing, of Philadelphia, before the International Congress of Applied Chemistry, and is used for regulating a 10-kw. carbon-plate resistance furnace, for which only direct current was available. It aims to dispense with the use of a power-consuming rheostat, by automatically opening the circuit once per minute, then closing it after a predetermined time.



ELECTRIC FURNACE REGULATOR

The control is effected by means of a small motor consuming about 50 watts, which drives, by small gears, a cylindrical cam *C*, 250 mm. long and 50 mm. in diameter, which is cut away on a taper from 350° at one end to 0° at the other. The pawl *P* is carried on a screw *Z*, which can be turned by a handle *H*, to set the pawl quickly and accurately in any desired position. When the pawl is resting upon the cam, the control switch *S* is closed. This automatically closes the clapper switch carrying the current; when the pawl drops, the control switch *S'* is closed, opening the clapper switch and cutting off the supply of energy from the furnace.

It is evident that the fractional amount of time during which the current is supplied to the furnace varies with the position of the pawl on the cam. While heating the furnace, the automatic switch is at rest; when the desired temperature had been attained, the motor which actuates the switch is started and the cam set to the position which has been found by trial to furnish the energy required to balance the losses by radiation. The pawl may easily be set to within 1.0 millimeter.

The control of the furnace is further effected by placing in series with the carbon resistance, an auxiliary resistance of 0.2 ohm of nichrome tape, which increases to 0.3 ohm at the maximum temperatures attained. The furnace is usually operated at 1300° C, and as this is too high for the nichrome to withstand permanently, the latter is placed in the base of the furnace, where the temperature will not exceed 1100° C. The increase of resistance of the nichrome with the rise of temperature tends to offset, in some degree, the diminishing resistance of the carbons, and so to prevent any accidental overheating of the furnace in case of failure of the operator to look after the adjustment of the controlling device.

California Oil Dividends in October

The following is a list of dividends paid during October, 1912, by listed California oil stocks, as compiled by the San Francisco *Chronicle*, making a very flattering showing:

Amalgamated	$1.00	$50,000
American Pet., pfd	0.005	8,755
do common	0.00 1-3	39,607
Caribou	0.00 1-3	8,070
Central	0.0075	7,500
Claremont	0.01	5,000
Columbia	0.01	9,992
Fullerton	0.10	60,000
Home	0.01	5,000
Monte Cristo	0.025	12,500
Mount Diablo	0.015	7,500
New Pennsylvania	0.005	5,000
Olinda Land	0.0075	15,000
Pacific Crude	0.10	60,000
Paraffin	0.01	3,000
Record	0.01	5,000
Rice Ranch	0.015	4,500
S. F. & McKittrick	0.01	5,000
Sauer Dough	0.0075	2,992
Section Twenty-five	0.50	20,000
State Consolidated	0.01	5,000
Traders'	0.006	9,000
Union Oil	0.006	184,744
Union Provident	0.006	91,402
United Petroleum	0.006	48,451
W. K.	0.02	10,000
Western Union	0.005	5,000
Total Cal. companies		$668,113
Mexican Pet. pfd	0.20 2-3	80,000
Grand total		$748,113

During 1911 the U. S. Geological Survey had 13 parties employed in Alaskan surveys and investigations. The personnel included 12 geologists, four topographers, two engineers and 30 packers, cooks and other auxiliaries. The length of the field season ranged from three to six months.

PERSONALS

Mining and metallurgical engineers are invited to keep The Engineering and Mining Journal informed of their movements and appointments.

There is a vacancy in a junior position on the editorial staff of the JOURNAL. Applicants are requested to call in person.

L. Vogelstein sailed for Europe on Nov. 14, expecting to return in about four weeks.

H. H. Johnson, of Johnson & Hoffman, has returned to London from British Columbia.

Harry J. Wolf has recently examined mining property in the Cripple Creek district, in Colorado.

Charles F. Rand, president of the Spanish-American Iron Co., went to Cuba on Nov. 16, and is due back on Dec. 10.

Samuel Price, Ontario mining commissioner, has resigned, and T. E. Godson, of Bracebridge, has been appointed as his successor.

P. L. McCardell, deputy mineral surveyor, is surveying the Luthy group of claims in the Gold Basin section, in Arizona, for patent.

Berthold Hochschild, president of the American Metal Co., sailed for Europe on Nov. 21, intending to return in about a fortnight.

E. F. Thompson, well known in Mohave County for the past 20 years, has opened up a mining office in the Lovin & Withers Block, Kingman, Arizona.

Edward E. Slick has been appointed general manager of the Cambria Steel Co., Johnstown, Penn. H. W. McAteer has been named comptroller.

M. J. Butler, who recently resigned his position as general manager of the Dominion Steel Corporation, will shortly leave Canada on a visit to England.

Percival Johnson has been elected general manager of the Pulaski Iron Co., operating Pulaski furnace at Pulaski, Va. He succeeds John W. Eckman, resigned.

Information is asked from anyone who may know the present whereabouts of W. Bertram Hancock, who in 1901 had charge of the operations of the Boston & Seven Devils Copper Mining Co., in Idaho.

Frank H. Probert has left Los Angeles for Clifton, Ariz., to make a geological examination of the Shannon Copper Co., for which company he has recently been appointed consulting engineer.

Dr. L. D. Godshall, of Los Angeles, Calif., has been in Kingman, Ariz., to look after his business interests in the county. He expects very soon to open a low-grade lead property at Tecopah.

Capt. Robert W. Hunt is to be awarded the John Fritz medal this year. The exercises in that connection are scheduled to take place in New York, Dec. 5, under charge of the American Society of Mechanical Engineers.

William H. Wright, who for eight years has been with the Zenith Furnace Co., Duluth, Minn., has resigned, and after Jan. 1 will be with the United Coke & Gas Co., New York, in charge of its operating department.

W. H. E. Royce, formerly general superintendent of the coke operations of the Republic Iron & Steel Co., Youngstown, Ohio, at Uniontown, Penn., has gone to the Connellsville Basin Coke Co., at Rock Forge, W. Va., as manager.

Frederick K. Brunton has resigned from the testing department of the reduction works, at Anaconda, Mont., to accept a position at Greenwood, B. C., as assistant superintendent at the British Columbia Copper Co.'s smelting works.

Eugene R. Pickrell has been appointed chemist in charge of the laboratory at the Customs Appraiser's office in New York. He has been connected with the office for some time, and was formerly at Kansas City and at the Denver mint.

Edward B. Cook, until recently general manager of the Warwick furnaces, Pottstown, operated by the Eastern Steel Co., Pottsville, Penn., has resigned and accepted a position in the ore and blast-furnace departments of Pickands, Mather & Co., Cleveland, Ohio.

John Hulst, formerly chief engineer in the Youngstown district for the Carnegie Steel Co., has been appointed chief engineer at Pittsburgh to succeed E. E. Slick, who resigned Nov. 1 to become general manager of the Cambria Steel Co. Mr. Hulst entered the employ of the Carnegie company in 1901, and has been continuously with it since.

OBITUARY

James Collins died at Salt Lake City, Utah, Nov. 8, aged 58 years. He was born in New York, and went to Utah 25 years ago. He was engaged in mining for some 22 years, retiring from active work about three years ago.

William Ogilvie died at Winnipeg, Manitoba, Nov. 13, aged 66 years. He was noted for many years as an astronomer and explorer and came into especial prominence as the first governor of Yukon Territory. He was born at Ottawa and educated at local schools. He was employed by the Geological Survey of Canada, and by the Department of the Interior for a number of years, and was intrusted with important surveys with regard to the boundaries between Canada and Alaska, Ontario and Quebec, and the Northwest Territory and British Columbia. He was in the Yukon on exploration work when gold was discovered on the Klondike, and was appointed governor of the new territory then formed, holding office for three years, through the great rush which followed the discoveries. He was made a Fellow of the Royal Geographical Society in 1891, and in the same year received the Murchison medal in recognition of two years' continuous exploration in the Yukon and Mackenzie regions. He was the author of a book, "Early Days of the Yukon and the Klondike;" also of many official reports on his work. Recently he had been engaged in gathering water-power statistics for the Canadian government, his latest investigation being at Point du Bois, near Winnipeg. He leaves a widow and two sons.

Societies and Technical Schools

Geological Society of Washington—The regular monthly meeting was held in Washington, D. C., Nov. 13. The papers presented were: "The Work of the Conservation Congress," by David White; "Reconnaissance in the Southern Wasatch Mountains," by G. F. Loughlin, and "New Data on the Knox Dolomite in Tennessee and the Ozarkian in Missouri," by E. O. Ulrich.

Geological Society of America—The 25th annual meeting will be held at New Haven, Conn., Dec. 28-31. The society meets at Yale University on the invitation of the university. The meetings will be held in the university buildings. The unsatisfactory nature of the hotel accommodations in New Haven has heretofore prevented the society from holding its annual meeting in that city. The erection of the new Taft Hotel has, however, placed at the disposal of conventions admirable accommodations.

Coal Mining Institute of America—The annual meeting will be held at Pittsburgh, Dec. 18 and 19. The sessions will be held in the School of Mines building of the University of Pittsburgh. The tentative program includes a sketch history of the institute by its first secretary, William Seddon; papers by Eugene B. Wilson; one on "Roof Action," by R. N. D. Hall; one by W. L. Affelder on "Rib Drawing by Machine"; one on gas producers from the viewpoint of a mining man, and one on "Crushers," by George R. Delmater.

American Institute of Chemical Engineers—The fifth annual meeting will be held at Detroit, Mich., Dec. 4-7. The program includes papers on important chemical subjects, and ample opportunity for discussion is given. A full program of excursions to the many interesting chemical industries of Detroit and vicinty has been arranged. A wide variety of industries is represented, affording something of interest to every chemical engineer. One day will be spent at Ann Arbor, Mich., where opportunity will be given for the inspection of the laboratories of the state university.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

Nov. 13—The 16th annual convention of the California Miners' Association will meet in Native Sons' Hall, San Francisco, Dec. 9, 10 and 11. The chief business to be presented to the convention is the preparation for mineral exhibits from all mining states at the Panama-Pacific Exposition, in 1915. The special matters to be considered in the interests of Californa and other Pacific Coast States embrace conservation and the employers' liability laws. The governors of the several mining states have been requested to appoint delegates to the convention to consider the matter of proper representation at the exposition, and a number of the governors have made the appointments. Boards of supervisors and chambers of commerce and other like bodies in California have also been requested to appoint delegates to the convention. The railroads have announced a rate of one and one-third fare to delegates. Invitations have been sent to the Secretary of the Interior, the director of the U. S. Geological Survey and the director of the U. S. Bureau of Mines, to attend the convention. Appointments of delegates have been made by Massachusetts, Texas, Nevada and California. Governor Eugene N. Foss has appointed W. B. Buckminster to represent Massachusetts. Governor O. B. Colquitt has named the following delegates to represent Texas: Dr. William B. Phillips, of Austin; M. Blumenkrantz, Hon. William Bugess, R. G. Canby, William Crosby, L. H. Davis, Martin Fishback, James J. Ormsby, M. B. Parker, W. W. Turney and Horace B. Stevens, of El Paso. Governor Tasker L. Oddie, of Nevada, has named the following: James L. Butler, Frank Keith, Charles E. Knox, John G. Kirchen, of Tonopah; H. C. McTerney, of Eureka, Frank Bradshaw, of Tonopah, Hon. J. A. Miller, of Austin, W. Brougher, of Carson City, E. A. Julien, of Fairview, and John C. Skuse, of Mina. The following named have been appointed by Lieutenant-Governor A. J. Wallace, to represent California: Will. J. French, J. A. Pillsbury, Willis I. Morrison, George C. Pardee, Curtis H. Lindley, E. C. Hutchison, of San Francisco; Prof. C. D. Marx, of Stanford University, Harold T. Power, of East Auburn, J. P. Baumgartner, of Santa Ana, and Francis Cuttle, of Riverside. The following compose the executive committee of the California Miners' Association: Charles G. Yale, C. M. Belshaw, E. C. Voorhies, Edward H. Benjamin, A. A. Tregidgo, S. B. Christy, Louis Rosenfeld, Thomas Clark, J. J. Hamlyn, E. B. Braden, Edward Coleman, N. Cleveland, F. W. Bradley, George W. Starr, Louis Sloss, Frank H. Buck, A. Carrigan and J. D. McGilvray.

There has been a large amount of rain in California during the latter part of October and the first half of November. In the higher elevations and in some of the foothill mining districts there has been an appreciative amount of snowfall. The last mining season was considered a dry one, owing to the light snowfall of last winter, and some of the gravel mines were affected, though only a few quartz mines were seriously disturbed by a lack of water for milling purposes. There are comparatively few quartz mines in California at present directly dependent upon water for power. Electricity is rapidly displacing water power, to the betterment of the mining industry. The present indications are that there will be a plentful supply of water during the coming season.

Denver

Nov. 16—The Moffat tunnel bill, recently referred to in this column of the JOURNAL, was defeated in the state vote, though carrying a big majority in this city. Now, however, a plan is being considered by which the city and county of Denver will undertake the work. The opinion has been given by the city attorney, that the quickest way in which the city can give its aid, is to vote bonds under the 20th amendment to the state constitution, for the purpose of boring the tunnel so that it can be used to bring a water supply for Denver from the head waters of the Fraser River from the western slope, the tunnel to be made large enough for railroad puposes. The governor of Utah and the Salt Lake City Commercial Club are coöperating with the Denver chamber of commerce, and there is a possitive feeling now that the tunnel will be built, and that an eastern outlet will be provided for the coal of the Yampa field, and the various products of the rich strip of country between that place and Salt Lake.

On Nov. 13, Governor Shafroth appointed the following delegates to the American Mining Congress, which meets in Spokane, Wash., Nov. 25-29: A. V. Hunter, Leadville and Denver; David R. C. Brown, Aspen; Allen Burris and James T. Burns, Colorado Springs; John T. Roberts, Jr., Ouray; Victor C. Alderson, Golden; John Campion, A. E. Reynolds and Philip Argall, Denver.

Butte

Nov. 13—E. O. Meinzer, of the U. S. Geological Survey, has been engaged for about a month in making an investigation of the valley south of Butte, locally known as the "Flat," to determine the possibilities of obtaining water for irrigation purposes from underground sources. In a preliminary report he states that the territory is underlain with granite, thus admitting small possibility of obtaining artesian water, but he continues, saying that the wash underlying the flat is saturated with water, confined by the rock walls of the basin, nearly to the surface. The supply is the result of precipitation and flowing water from a few small streams from the surrounding mountains, and while extensive pumping would without doubt exhaust the supply, it would be sufficient, if used judiciously, to irrigate a large area. In order to develop the water supply, he recommends that a pit be sunk to water level and a pump installed in it; that a vertical hole be then bored from the bottom of the pit, of sufficient size to admit a six-inch casing freely, and after perforating the bottom of the casing, allow it to follow the drill; whenever a promising water-bearing deposit, such as gravel, is penetrated, sink the casing with the perforated end in the deposit, and by hard and long pumping clear out the silt and fine sediment in order to develop a porous bed of coarse grit and gravel to act as a natural strainer. After the hole has been sunk to the desired depth, the casing can be perforated at every point where it passes through satisfactory water-bearing deposits. If this well should prove successful, Mr. Meinzer recommends the installation of a single-stage centrifugal pump and electric motor, with capacity to lift to a height of from 40 to 50 feet.

Salt Lake City

Nov. 14—A meeting of the Utah branch of the American Mining Congress has been called for the evening of Nov. 21, by Duncan MacVichie, president of the Utah branch, and John Dern, a director and former president of the congress. There will be considered the question of compiling statistics in regard to the cost

of production of lead and zinc, to be placed, if necessary, before the Ways and Means Committee, at Washington, when the matter of the metal tariff comes up. The meeting will also take up the question of defeating any attempt to amend the national right-of-way laws, as well as the necessity of bringing about a reversal of the recent ruling of the Department of the Interior in regard to patents for mining claims.

Conditions at Bingham are steadily improving. The mines are gradually increasing their working forces and adding to their output, although these are not yet up to normal. Many miners left the camp at the time of the strike to avoid possible trouble, and the war in the Balkans has brought about a general exodus of foreigners. New men are coming in, and old ones returning. At the Bingham mines, at Lark, 45 men are employed, two shifts being worked. Utah Consolidated has 150 men at work, and the Bingham-New Haven mill is running.

Negaunee, Mich.

Nov. 15—The results of the 1912 appraisal of the mines of Iron County have been announced by the state tax commission, which is now engaged in revaluing Michigan's iron mines, to determine changes since the Finlay appraisal a year ago. The valuations given for the new explorations are especially interesting as denoting what success has been met by the different companies in the active fields of Iron River and Crystal Falls. The Nevada Land Co. explorations, including the famous "Mastodon find," at Crystal Falls, are assessed at $565,000. As nothing has been done at these properties beyond diamond drilling, the figure indicates that a large orebody is estimated.

The Carpenter property of M. A. Hanna & Co., where a shaft is being sunk, is estimated at $275,000, and the Monongahela and Ravennah at $75,000 and $100,000, respectively. The Amasa-Porter lands are assessed at $180,000. At Iron River, the Sherwood property of the Republic Iron & Steel Co., where drilling has been in progress for two years, is assessed at $740,000. The Bengal mine, being developed by the Verona Mining Co., is assessed at $1,139,000; the big Caspian mine of the same company has the record valuation of the county at $3,861,000. The Forbes mine, of Jones & Laughlin, the Rogers mine, of the Munro Iron Mining Co., and the Zimmerman mine, of the Spring Valley Iron Co., all new mines, are assessed at $450,000; $414,000, and $481,000, respectively. The Bates mine, of the Florence Iron Co. interests, and the Erickson exploration, of the Cleveland-Cliffs Iron Co., are only figured at $80,000 and $81,000, respectively.

The new Wickwire mine is assessed at $145,000. The Mineral Mining Co.'s James mine, which in 1911 was raised from $75,000 to $623,000, is now increased to $660,000, and the company's Konwinski property is figured at $97,500.

The old Hemlock mine, of Pickands, Mather & Co., at Amasa, was lowered from $68,000 to $51,000. The Chicagon mine, of the Munro Iron Mining Co., which has been a heavy shipper during its two years of activity as a producing mine, was lowered to $44,000. Taking the county, as a whole, the deductions made for ore mined were more than compensated by new discoveries.

Porcupine

Nov. 16—The Porcupine branch of the Western Federation of Miners called a general strike, Nov. 15, a vote taken by ballot the previous day being in favor of a strike by a large majority. All the union men employed in the camp went out, and nearly all operations are suspended. The original dispute affected only five mines near Pearl Lake, the operators of which introduced a new scale of wages involving some reductions. The federation took up the matter and appealed to the Canadian Department of Labor, which appointed a board of conciliation to investigate the case, consisting of Prof. H. E. T. Haultain, representing the mine owners, E. Thompson, secretary of the miners' union, and Peter MacDonald of St. Thomas, chairman. A majority report of the commission was brought in, to the effect that with one minor exception the wages offered were fair and adequate. The operators decided to put the new wage schedule into effect, whereupon the men rejected the recommendations of the commission, and submitted the question of a strike to a referendum vote. The scale offered to the men is the same as prevails at Cobalt where a nine-hour shift is worked, and as the rate at the Dome and Hollinger, but the other mines have been paying slightly more. The mine managers state that the mines around Pearl Lake early in the history of the camp established a scale of wages higher than the average, because the men were then required to work under conditions less favorable than those which now prevail. The number of men out on strike at the leading mines is given approximately as follows: Dome, 300; Hollinger, 300; Vipond, 50; McIntyre, 60; McEnaney, 80; Dome Lake, 60; Hughes, 40; Porcupine Lake, 50; Hollinger Reserve, 50; Jupiter, 25; Pearl Lake 20; Plenaurum, 30; Dome Extension, 25; Three Nations, 20; Krist, 10. Some other smaller properties in the district are affected. The mine owners are expected to make a strong stand as it is generally believed that the men have little grounds for grievance. The wages paid compare favorably with those of the western camps as the machine workers are paid $3.50 per day and other labor in proportion with 75c. per day charged for board. While the trouble may interfere with operations to a considerable extent for some time, it is believed that the strike will not be of long duration. Financially, the union is in poor shape, and the men are going out without strike pay. On account of the Magpie and Helen mines in the Lake Superior district, closing down for the winter, about 500 men will be let out there and it is believed that sufficient men can be brought into the camp to carry on the work. The mine owners prefer to close down for the winter rather than pay higher wages. The Hollinger and Dome, however, will probably bring in men from the outside.

Juneau

Nov. 16—The practical completion of one of the largest power projects in southeastern Alaska was marked by current coming over the transmission lines, Nov. 10, from the Nugget Creek power plant to the distributing station at Treadwell. From the dam site at Nugget Creek basin, which is at an elevation of 530 ft., a tunnel 635 ft. in length, 12 ft. wide and 8 ft. high was driven to the ridge that divides the basin from the bench above Mendenhall glacier. From this place 3850 ft. of wood pipe 48 in. in diameter was laid to the place known as Lookout, where it was connected with 2060 ft. of 36-in. steel pipe, which brings the water to the power house. The laying of this pipe in itself was a big undertaking, and was accomplished by aërial cables that lifted the sections from a distributing point and carried them to their destinations. All the pipe had to be securely anchored against slides and the heavy pressure that would be on the pipes at all times. The power house, which was recently completed, has a capacity of 3000 kw. Only one generator of 1000 kw. capacity has been installed, but another is on the way from Seattle and is to be installed in the spring. The power plant consists of three Pelton waterwheels driving two units, one of 1000 kw. and one of 2000-kw. capacity, with necessary waterwheel governors, exciters, etc. Electrical power is generated at 2300 volts and transmitted to the distributing board at Treadwell where it is stepped down. Fourteen miles of transmission line have been built connecting the power house with the central electric plant at Treadwell. To provide for the storage of water so that power can be generated all the year round a reinforced-concrete dam will be built at Nugget Creek basin. This will be 100 ft. high and 615 ft. across the face. The dam will have a storage capacity capable of furnishing 4000 hp. for four months. The total cost of the undertaking will be about $600,000.

The Mining News

The Current History of Mining.

Alaska

On account of the heavy frost practically all the workings at Fairbanks have been closed down, including the McGuire & Chapman, Two-Step, Louis Schmidt and Charles Schieck, all on Nome Creek.

The total cleanup of the Long Creek district this season will be in excess of $100,000.

Pioneer Mining Co.—The biggest strike at Nome since 1905 has been made by this company in an old channel opposite No. 3, Anvil Creek. The pay dirt runs 25c. per pan.

Arizona

Maricopa County

Smith Bros. have been developing copper and gold prospects northeast of Morristown.

The placer claims on the Hassayampa River near Brill's ranch, Wickenburg, have been bonded to Georgia men and active development will be started at once. A. J. Kellis and associates were the locators.

Harry J. Bennett has bonded a group of claims in the Picacho district near Morristown to Eastern men. Work on the claims is to be commenced in December. Some work has been done on some of the claims and copper ore opened.

Vulture—A survey for a pipeline from the Hassayampa River to the mine has been completed, but as sufficient water for the concentrator has been obtained by drilling wells near the mine, it will not be necessary to build the pipeline immediately.

Tip Top—The dumps at this old silver mine are being milled and shipments of concentrates will probably be made at an early date. The concentrates contain silver as well as tungsten. The tungsten is of more value than the silver contents.

Congress—The dumps have been sold to the United Verde for lining converters at the new smeltery which is being built at Clarksville. The tailings are almost pure quartz and there are several million tons in the dumps.

Carney—A carload of copper ore will soon be shipped from these mines to the smeltery at Hayden.

North Star Mining Co.—Development work has been done on this group of claims, south of Phoenix, near Telegraph Pass. Present showings justify a continuation of the developments; the veins are large on the surface and the assays are satisfactory.

Mohave County

An examination of the Smith & Sawyer molybdenite property, in Copper Cañon and Deluge Wash, about five miles north of Cedar, was made last week by Anson H. Smith, O. B. Stanton and Philip Smith. Mr. Smith reports about 300 tons of ore on the dump, a sample from which showed more than 24% molybdenite and about 3% copper. About 140 ft. of driving has been done on the property.

Cyclopic—A strike has been made below the old workings by S. C. Bagg, who has been operating this property for several years.

Tom Reed—It is reported that a rich strike has been made on the 800-ft. level.

Last Chance—Due to the failure of the O. & C. Development Co., this mine and the recently erected mill have reverted to the original owners. W. E. Frost, Walter Meyer and Harry Mehaffey are engaged in stoping out sufficient ore for a mill run of several days duration.

Tennessee—It is stated that at this mine, at Chloride, a large shoot of lead ore has been discovered on the 700-ft. level. The shaft is being sunk to the 800-ft. level where the evidence indicates that the same oreshoot will be encountered. The railroad extension to the mine will soon be completed so that shipments to the Needles smeltery may be resumed.

Williams—Ten tons of ore from this tungsten property will soon be shipped for a concentration test. The property was recently examined by Edward B. Sturges, of New York, and, upon his recommendation, was taken over by a company formed by James A. Roberts, of the Frisco Gold Mines Co.

Arizona Southwestern Copper Co.—The drift from the 200-ft. level of the main shaft has been driven a distance of 1400 ft. and is within about 100 ft. of connecting with the north shaft at the 300-ft. level. The main shaft is to be sunk an additional 200 ft. The new 150-ton mill is rapidly nearing completion, the building and foundations for the machinery being finished, and the equipment is now being placed in position.

Santa Cruz County

The Southern Pacific R.R. has fixed the minimum load at which ore can be sent at the car rate, at 30 tons; it was formerly 15 tons. This will make a little difference with silver-lead shipments which are apt to come forward in small lots, but will have little or no effect on copper shipments from this county.

Blue Eagle—McDonnel, Kane & Stevens have taken a lease on this copper mine in the Patagonia district, and have some good ore on the dump.

Royal Blue—Thomas Fraser, who has a lease on this mine, has just struck copper ore and a heavy flow of water in the lower east tunnel. The ore contains copper with some gold and silver, and is in demand by the smelters. One carload is in transit.

California

Alameda County

The Corral Hollow manganese deposits have been purchased from the McLaughlin company by Atkins, Kroll & Co., of San Francisco. It is reported that a road will be built from the mines to Castle Rock spur on the Tesla branch of the Western Pacific Ry.

Amador County

South Jackson—A station has been cut at the 500-ft. level in the shaft.

Butte County

J. F. Upton has filed on 100 miners inches of water in McCabe Creek to be used for mining purposes in the Forbestown district.

Hupp—An incline shaft is being sunk in this gravel mine at De Sabla to cut the gravel in what is known as Indian Spring channel, which in early days was one of the largest producers in the county; G. K. Orr, superintendent.

Berry Creek—The final payment for this property has been made and new buildings are being erected. J. N. McClung and John Kincaid, of Berry Creek, are owners.

Calaveras County

Dolling—This mine, formerly known as the North Star, has recently been explored from the 400-ft. level by a winze that has developed ore above average value. Preparations are being made for stoping. It is expected that the stamp mill will soon be in operation again.

Brown-Smith-Ryland—The mill has been started on good ore recently disclosed in this mine near Angels Camp. The property had been idle for 30 years, and work was resumed this year. Charles D. Smyth is the only remaining member of the original locators.

KERN COUNTY

King Solomon—A recent cleanup of 25 tons of ore from the Teagle-Lamberson lease plated $1100, or more than $40 per ton at the Red Dog mill. The ore was taken from the 75- and 125-ft. levels.

Consolidated Mines—A strike is reported at the west end of the 236-ft. level in the Good Hope claim. It is reported that a vein of $40 ore was disclosed. This will be driven on. The shaft is being deepened and has now reached a depth of 300 ft. About 50 tons of ore has been hauled to the Red Dog mill.

INYO COUNTY

Custer—A large shoot of lead-silver ore is reported to have been disclosed below the 220-ft. level. The main shaft has been straightened. Regular shipments are being made; John Thorndyke, owner.

Lucky Jim—A new 50-hp. gasolin hoist and a compressor have been installed. Sinking on the lower level will be continued; J. P. Fitting, superintendent.

Defiance — This property has been leased by John Gunn, of Independence. The mine was formerly a large producer. There is now a large quantity of ore blocked out.

Green Monster—This mine, near Citrus, has been leased by Edward Chaffy. Three carloads of copper ore were recently shipped to the Wabuska smeltery.

MADERA COUNTY

Lucky Bill—This mine, near Ahwahnee, is reported to have been bonded by Mr. Richardson, of San Francisco. Extensive development is contemplated.

MARIPOSA COUNTY

Schoolhouse—This property, near Hunters Valley, has been bonded to P. G. Gow, of Berkeley. Should development warrant, the machinery formerly used at Big Oak Flat will be used in mill construction; W. Taylor, superintendent.

Melvina—Preparations are being made for reopening the mine, in Coulterville district, which has been idle for about 10 years. The power line of the Pacific Gas & Power Co. is being extended from the Oro Rico mine to the Melvina; Merced Mining Co., owner.

MERCED COUNTY

It is reported that arrangements are being made for the development of the marble quarries near Planada. The marble will be hauled to the railway station at Planada with auto trucks.

MODOC COUNTY

Consolidated Mines Co.—The attachment of James Williams has been disposed by J. M. Stone, the principal owner, who bought in the property at $29,500. Preparations are being made for reopening the mine in the spring. This is reported to be one of the best properties in the Hoag district.

Lucky Dutchman—The new shaft house is completed. The new shaft has reached the 42-ft. point, passing through the rhyolite and disclosing good ore in the porphyry; A. L. Arnold, manager.

Colorado

CLEAR CREEK COUNTY

Virginia City—Ore, 1½ to 3 ft. wide has been opened in this mine on Lincoln Mountain, by Arthur Robert, lessee, the first shipment made giving returns of $77 per ton in gold and silver. It is being operated through the Lincoln crosscut tunnel 1350 ft. from the portal. The shoot has been proved for 100 ft. in length and two men are breaking two tons per day.

LAKE COUNTY-LEADVILLE

The lack of cars to transport ore continues. In October the shipments fell off 300 carloads for that reason. The shortage is so great that the Rio Grande is hauling ore from Leadville to Salida in narrow-gage cars and transferring ore billed to Missouri, Kansas and Oklahoma to broad-gage cars. The farmers and fruit men are suffering more than the miners; their products being perishable, they must be served first.

Yak Tunnel—A winze is being sunk in the tunnel near the center of Big Evans basin, to develop Diamond and Vega ground. It is down 150 ft. and will be sunk another 100 ft. when it will be 1100 ft. below the surface; then drifts will be driven into Yak territory to open the known ore.

St. Louis—The winze in this Breece Hill mine is 320 ft. deep and has 140 ft. more to go, when Manager Stewart says he will start driving to the ore.

Adelaide—Manager Covey is now hoisting ore at the south end of this claim in Adelaide Park, and is increasing shipments of high- and medium-grade ores.

Baby—Lessees on the shaft are shipping richer ore and in greater quantity. They state that if they can continue doing this a little longer, an increased force will be put on.

Alicante—A strike has been made on this Collier-Lewis claim and it is reported that in a raise a vein of rich ore 18 in. wide has been opened. Two tons has been sacked for shipment; W. B. Anderson in charge.

SAN JUAN REGION

The shipments of crude ore and concentrates shipped from Ouray during the 10 months of 1912 are given at 15,101 tons, the major part of which was shipped by the Camp Bird, Wanakah, Atlas, Revenue, and Wedge mines.

O. B. Willmarth, buyer of carnotite ores, is building a storehouse at Placerville, the shipping station for the carnotite ores bought in Paradox Valley. There are five carloads on the ocean *en route* to Europe.

Smuggler Union—This company has taken a three-years' bond and lease on nine claims on Cornet Creek owned by the Moorehead Mining & Milling Co. They adjoin the Mendota of the Smuggler company, and the general ,manager Bulkely Wells, is already working them through the Mendota mine. It is said that the acquisition of this property will add many years to the Smuggler Union Property.

TELLER COUNTY-CRIPPLE CREEK

Forest Queen—It is reported that G. Johnson, a lessee on this Ironclad Hill mine, has opened a flat vein of good gold ore, of which he may be able to mine three carloads this month.

Blue Bird—The 21st-level station has been cut at a depth of 1750 ft. and crosscuts both to east and to west from the shaft are being advanced at the rate of five feet per day, No. 8 Leyner drills being used. The bottom of the shaft is just two feet below water level. No water is pumped. By keeping the bottom of the shaft in water the difficulty due to foul air is overcome. This air always manifests itself as soon as the bottom of the mine becomes dry. A winze is being sunk from the 20th level south to prospect ground to water level at this place. E. S. Johnson is manager.

Isabella—A rich strike is reported to have been made in the bottom level, in territory operated on company account.

El Paso—The new hoist installed at the Nichols shaft will soon be in operation. The company is preparing to operate on the tunnel level.

Golden Cycle—The new electric pumping plant is in operation. This plant will drain the lower workings of both the Golden Cycle and Vindicator mines, and the cost of pumping at both mines will be greatly reduced as compared with former methods.

Six Points—The October production by lessees, Polly & Chilson, was nine carloads of mill ore. It came from the seventh level of the Los Angeles shaft.

Gold Sovereign—A dividend of ¼c. per share has been declared upon a capitalization of 2,000,000 shares, amounting to $4500, this coming from royalties paid the company by lessees.

El Paso-Gold King—Three strikes of ore of unusual width and richness are reported from this mine by lessees.

Anchoria Leland—It is anticipated that this mine on Gold Hill will again commence shipping to the Valley mills, as late extensive development has shown several good oreshoots.

Idaho

Bonner County

Idaho-Montana—The first carload of lead-silver ore has been shipped and the second will follow shortly. The ore comes from the strike made recently on the 320-ft. level.

Cœur d'Alene District

"Y" Group—An oreshoot, carrying galena of shipping grade was encountered in the upper tunnel, and crosscutting has been begun to determine the width of the shoot. The ore shows a good tenor in lead and silver and an absence of zinc, which is common in most of the Pine Creek mines.

Tuscumbia—The management has decided to continue development throughout the winter, opening up the strike recently made on the 600-ft. level through the No. 3 adit on the Idora Hill.

Idaho County

South Fork—A bar of bullion, valued at $3000, was recently shipped to Spokane.

Michigan

Copper

A transaction was recently concluded and the transfer made of about 18,000 acres of land in Houghton and Baraga Counties for a hydro-electric plant on Sturgeon River. It is estimated that this plant can eventually develop about 20,000 kw. Right-of-way for the transmission line has been secured, which will take in the South range group of mines in Houghton County and also enter the village of Houghton. Development work will be started at an early date.

None-Such—M. P. O'Brien will be in charge of development and exploratory work at this property. The Calumet & Hecla company held this property under option at one time and did much exploratory work, but allowed the option to expire. However, the developments at the adjoining White Pine property of the Calumet & Hecla have been so successful that attention is again to be given this property. The ore carries much copper in a flaky state and the problem of successful operation seems to be one of concentration.

New Arcadian—This company's shaft is sinking below a depth of 250 ft. at the rate of from 70 to 80 ft. per month. At a depth of 500 ft. a station will be cut and crosscuts will be driven east and west to cut the other two lodes. The shaft is going down on the middle of a series of three lodes that were exposed in drilling.

Winona—Production is gradually on the increase at this property. Additional labor has been secured for underground work and a tonnage is now being handled that is sufficient to keep one of the stampheads working continuously at full capacity and the other about half time. The introduction of tube mills has made a material saving in the copper that was previously going out in the tailings.

Hancock—Crosscuts are to be extended at the 2600-, 3600- and 3900-ft. stations of No. 2 shaft to cut the formations and to become the main working levels. Within the next few months this property will be producing and sending ore to the Lake Milling, Smelting & Refining Co. mill at Point Mills. Openings on the No. 3 lode are satisfactory and the mill run showed that this formation can be mined at a substantial profit with a fair price for the metal. The surface equipment is equal to the finest in the district, the property being equipped to handle a large tonnage just as soon as the underground workings can be put in shape to yield the ore; 8-ton skips have recently been put in commission.

Isle Royale—The pit at the site of the new No. 7 shaft has been started and as the overburden is not very heavy, solid rock will soon be reached when the collar can be put in and sinking go forward on the lode.

Osceola Consolidated—The construction of the new steel rock-house at the No. 1 shaft of the North Kearsarge branch of this company is progressing satisfactorily and the building will be inclosed within a few days. A temporary hoisting equipment has been rigged up to take care of the shaft repairs while this work is being done. Production from this shaft has been suspended for some time, but the tonnage from shafts No. 5 and 6 of the main mine are about equaling the amount of decrease.

La Salle—Preparations are being made to resume operations at this property, which have been suspended for about one year. At shafts Nos. 1 and 2 larger rock-houses are being built and put in shape to handle an increased tonnage. No. 1 shaft on the Tecumseh tract is opened extensively and the lower levels were developing some good ground at the time operations were suspended, but owing to the prevailing low price of copper it was deemed advisable not to spend any more money at that time in further opening the property, but at the present price of the metal the company will make a substantial profit.

Calumet & Hecla—This company has put an enlarged hoisting engine in commission at its No. 15 shaft on the Osceola lode and has put the two compartments of the shaft in shape to handle ore, so that production from this shaft will be materially increased. The company is also installing new underground pumps in No. 4 shaft of the Calumet branch of the mine, to supplant the air-driven pumps.

Iron

Warner—A decision has been handed down by the state supreme court, in the case of the German Aid Society *vs.* the German Corporation, confirming the decision of Judge Flannigan given a year ago. The Warner land in the Cascade district was deeded to the German Aid Society of Negaunee by the owner, Charles M. Warner. The surface rights were later sold as farms to individuals by the society, but the mineral rights were reserved. The 38 members of the society attempted to deed the mineral rights to themselves under the name of the German Corporation, planning to exclude later members of the German Aid Society from a share in the Warner land. Ore has been found on the property and on adjoining lands, and the later members of the society sued for a share in the mineral rights.

Volunteer—This mine of the Volunteer Ore Co., sometime called the Maitland shaft, at Palmer, has reopened with a force of 150 men. The mine was closed last June because of the low prices prevailing for iron ore; previous to closing 200 men were employed. The mine has been kept pumped out and repairs to the shaft have been made. A stockpile of 80,000 tons of high-grade bessemer ore is on hand. The company is controlled by Duluth men, including T. F. Cole, G. A. Tomlinson and C. A. Congdon. Thomas Pellow, of Negaunee, is general superintendent.

Oliver Iron Mining Co.—Following a visit of officials of the U. S. Steel Corporation, extensive improvements are being started at the Oliver water power plant at Quinnesec Falls on the Menominee River. Additional power will be obtained for operating the company's mines on the Menominee range.

Missouri

Joplin District

Yellow Jacket—A third shaft is being sunk on this lease by O. W. Sparks. Ore is found in soft ground, and heavy timbering is required.

Athletic Mining Co.—Two 40-acre leases are being developed by this company, in the north Webb City sheet ground. The terms of the lease specify that new plants be put up on each "forty."

Bull Moose Mining Co.—This company, operating near Belville, has made one of the richest strikes in recent years. In sinking a shaft through the ore run, 103 to 123 ft., enough mineral was taken out to pay all costs of sinking.

Reo Mining Co.—This company has just been incorporated for $32,000, the stockholders being Carthage and Carterville men. They have a lease on a prospected

tract of 15 acres five miles west of Sarcoxie.

Betsy Jane—The initial yield of this mine, valued at $15,000, has just been transported by wagons to the cars at Thoms Station, for shipment to the smeltery.

Hoo Hoo Mining Co.—This company is building a mill of 150-tons capacity on a 15-acre lease of the Expansion Realty Co. Shallow operations were conducted on this land in the early days of the camp, but it has lain idle since. The company has two shafts in ore, one in soft gound at 140 ft., and the other in sheet ground at 180 feet.

Thomas C.—Carterville and Duenweg men have procured a 40-acre lease on the Four Hundred Prospecting Co.'s land, southeast of Duenweg. It is understood that they intend to reopen the old Thomas C. mine, in which good ore was opened by former operators, but no systematic mining has been done. Pumps have been started to drain the old drifts.

Captain—A sludge mill, with an equipment of four tables, has been installed on a lease of the Continental Zinc Co. land, to treat tailings from this old mine.

Montana

Butte District

Davis-Daly—During the year ended June 30, 1912, this company received $106,299 from ore shipments, and from interest on capital, $7029, a total of $113,328. The expense of development and mining amounted to $199,029, and general expense to $41,638, a total of $240,667, making a total excess expenditure of $127,339. The loan of $50,000 made to the Ohio Copper Co. by the former management was returned, with interest at 6%, accompanied by a $5000 bonus. Also money invested in a Porcupine property was returned, with the addition of a stock bonus. The Colorado shaft has been sunk 200 ft. to the 1900-ft. level and much development work has been done from this shaft on the 1400- and 1700-ft. levels without, however, opening any new orebodies of importance. The crosscut now being driven on the 1900-ft. level of the Gagnon mine of the Anaconda company, to develop the western territory of Davis-Daly, has advanced about 650 ft., and is expected to intersect the Silver King vein at a further distance of 300 ft. Two crosscuts have been driven on the 1900-ft. level from the Colorado shaft, in both of which fault veins from one to three feet wide, and carrying from 3% to 5% copper, have been opened. Lessees are operating the Lizzie claim, in the eastern part of the company's ground, and a crosscut is being driven to develop this territory at a depth of 1000 ft. On the extreme northwestern portion of the holdings, lessees are operating the Silver King claim, with promising results. Ore shipments now amount to about 65 tons per day, which is an increase of 15 tons daily over the quantity shipped during the year prior to the first of October.

Lewis & Clark County

The proposed installation of an electric power line at Marysville is meeting with some opposition from some of the mine owners in the camp, who as yet have proved unwilling to bind themselves to an agreement to use the power for the time demanded by the power company as a safeguard to their interests. It is believed, however, that the matter will be arranged satisfactorily. Because of the high cost of transporting fuel to the district, an electric power line is almost indispensable to successful mine operation.

Bald Butte—On account of the bad condition of the road between this property and the mill where the ore is treated, mill operations have been temporarily suspended. As soon as a sufficient fall of snow occurs to make sleighing possible, operations will be resumed. The mine is being worked steadily in the meantime and the ore placed on a stockpile ready for hauling.

Eureka—Butte men recently began operations at this property in Mitchell Gulch, 12 miles east of Helena. The property has produced good ore in the past. A 300-ft. shaft is being sunk preparatory to a systematic course of development work.

Nevada

Comstock Lode

Mexican—A statement prepared by the company for the bullion-tax collector, shows that the ore recovery for the quarter ended Sept. 30, was 6055 tons, and that 5297 tons was treated at the mill. The gross bullion yield for the quarter was $125,945, and upon the net yield, a bullion tax of $1073 has been paid. The financial statement of the company as of Nov. 1, gives a cash balance of approximately $70,000 in the treasury, and at the next meeting of the directors, it is expected that a dividend of 20 or 25c. per share will be declared.

C. & C. Shaft—No. 2 vertical pump at the 2500-ft. level, the second unit of the temporary plant at that place, has been installed and works successfully. No. 1 hydraulic elevator is being removed, leaving only electrically driven pumps in the sump.

Ward Shaft—The work of dismantling the shaft has been completed, and all pumps and machinery have been taken from the 2100 and 2475 stations. Further attempts to unwater the Middle group of mines will undoubtedly be made through the Combination shaft.

Crown Point—Run No. 8 at the Yellow Jacket mill has been completed and two railroad cars of concentrates shipped to the smeltery. Plans are being made by the management for work along broader lines in this mine, as well as in the Belcher and Yellow Jacket. It will probably include the recovery of deeper levels.

Union Consolidated—Sampling the quartz stringers cut by the west crosscut on the 2500-ft. level has been completed, and development work will be carried on at the most favorable point.

Sierra Nevada—Two feet of quartz was recently cut on the hanging wall of the fault on the 2500-ft. level, which is said to be a drag from the main vein. The north drift is being driven across the fault for the main vein, which, it is believed, was thrown about 70 ft. off its regular course.

Nye County

Shipments in tons from Tonopah mines to date and for the week ended Nov. 9, are as follows:

Mines	Week	Year to Date
Tonopah Mining	3,250	151,069
Tonopah Belmont	2,647	110,843
Montana-Tonopah	617	46,069
Tonopah Extension	1,050	45,243
West End	745	34,302
Midway	50	820
MacNamara	390	16,779
North Star	45	311
Mispah Extension	....	40
Jim Butler	350	3,750
Totals	9,154	409,226
Estimated value	$228,850	

Tonopah-Belmont—A new vein of good milling ore has been opened on the 1100-ft. level.

Tonopah-Merger—The last drift on the 1070-ft. level is now cutting stringers of rich ore. Shipments from the mine will commence in a few days.

Montana-Tonopah—The production for October was 49 bars of bullion valued at $42,270 and 34 tons of concentrates.

Jim Butler—This mine has increased its shipments to 350 tons weekly and is now making monthly profits.

Nevada Wonder Mining Co.—The report for September states that 3406 tons of ore was treated for a net profit of $31,402.

White Pine County

There are still rumors of again calling a strike, owing to alleged discriminations in the reëmployment of old men. Several men, representing the different unions, are investigating these charges. It is said that the American Federation of Labor, in session at Rochester, N. Y., will decide the question. If left to a vote of the men now employed, it is believed that they will not go out, as they lost $225,000 in wages, during the October strike, and nothing was gained.

Nevada Consolidated—The concentrator at McGill, commenced running full capacity, Nov. 11, for the first time since the strike. The ore bins are full.

Giroux—The Bunker Hill, Brooks and Morris shafts will be retimbered and probably be sunk deeper. The ore shipments have come from these shafts, during recent months. Surface ore bins will also be built at the Morris, heretofore temporary ones have been used. The steam and water pipes in the Giroux shaft, need overhauling and some replacements, so that it is probable that no production will be made for several months. A large force is grading at the Brooks shaft, for a timber yard.

Ely Central—Under the management of R. T. Pierce the new company is prospecting its ground with a churn drill.

Butte & Ely—This company, owning ground between the Nevada Consolidated and Giroux, will start two drills. This work will be in charge of the Giroux company, as it owns half the stock.

New Mexico

Socorro County

Socorro—Custom ore is now being received from three properties, and two more are getting ready to ship. Good ore is coming from lowest levels of the mine. The shaft is going down steadily and will soon be to the 900-ft. level. The average daily tonnage handled in the mill is 165 tons.

Ernestine—The output for the last 11 days of October was 10,530 oz. of gold and silver bullion and 9600 lb. of high-grade concentrate; the total for the month was 33,080 oz. bullion and 25,100 lb. concentrates. The regular monthly dividend of 1% was declared Nov. 1. Mine developments continue in the same excellent grade of ore.

Deadwood—Before using the new automatic sampler for the custom ores, the equipment is undergoing a series of tests in conjunction with the old system of sampling, to determine its accuracy and, after a few further adjustments, all ores will be handled by it. The mill is running steadily, averaging 350 tons per week.

Oaks Co.—Grading is under way for the permanent shaft at the Johnson mine and plans perfected for extending the tunnel through to the end line. At the Pacific, good ore is coming from the stope and the several development headings. The Consolidated, being worked under lease from Socorro Mines, is yielding an excellent grade of mill ore.

Trilby Group—Work has just been started on this group, and it is the intention to ship ore to one of the custom mills. A gasoline hoist may be installed within a few weeks.

Mogollon Gold & Copper Co.—Arrangements have been made with one of the local plants to furnish current and an electric hoist will be installed at the Little Charlie mine.

Oklahoma

Ottawa County

Miami, with 15 mills in operation, shows a great improvement over last year, when there were only four or five mills running. It is estimated that 30,000 ft. of drilling has been contracted for, and that it is to be done within the next six months. Numerous strikes have been made in the north end of the camp, showing that the main run of ore extends in that direction.

Chapman & Lenon—The 14-in. pump installed by this company has lowered the water level by about 12 ft. in the last 30 days. The pump is throwing about 2000 gal. of water per min.

Prairie Mining Co.—After prospecting the 20-acre lease the second time, this company found 30 ft. of good lead and zinc ore in two drill holes. This was found at the depth of 225 ft. The company is now erecting a 250-ton mill and expects to be operating early in January, 1913.

Oregon

Baker County

Oversight—This property, in the Bull Run district, has been bonded to F. L. Hamilton and T. F. McGinty, of Seattle, who will start driving a 300-ft. tunnel at once.

Grant County

Maid of Oregon—This company is considering the purchase of a 10-stamp mill for the property, near Alamo, to be installed early n the spring. George W. Sherf is manager.

Utah

Beaver County

South Utah—At present, development work only is being carried on. Water was struck on the lower levels, and was left alone to see if it would rise to the 600 or tunnel level, but did not come above the 700. Some pumping is being done.

Cortez—Finley & Burke, lessees at this property, in the Star district, are still at work, and are mining some good ore.

Moscow—The new strike on the 500-ft. level is considered of much importance. The ore was cut about 250 ft. east of the shaft in the old Moscow vein. Drifting has been done for 125 ft., and the ore has measured from two to five feet in thickness. It is high-grade lead-carbonate ore, stained with copper, and assays well in silver. The south face shows ore of the same character, but the vein has not been drifted on in this direction. At present 15 cars per month are being shipped, exclusive of that from the new strike, largely from winzes and raises from the 500 level and above. Ore carrying lead, silver and copper has been opened on the 300 level. There is some talk of a new working shaft for more economical mining and development. The boilers, compressor and equipment are new, and the property is in excellent condition.

Juab County

Tintic shipments for the week ended Nov. 8 amounted to 194 cars, or about 9700 tons, exceeding the output of the week preceding by about 300 tons. There is still a shortage of cars, but it is thought transportation will be normal soon.

May Day—Shipments of zinc ore for October are stated to have left a balance of $12,000 in the treasury. The company began the month with an overdraft of about $8000, and during the month spent about an equal amount on supplies, etc. Zinc ore is being mined from between the 200- and 1000-ft. levels, and lead ore of shipping grade, running well in gold with some silver and a little lead, i reported on the 1100; 50 men are employed.

Uncle Sam—The capital stock was a short time ago increased from 500,000 to 750,000 shares, the par value remaining as formerly, $1, the company acquiring entire control of the Richmond-Anaconda, in which it already owned 400,000 out of 500,000 shares. The Uncle Sam now announces itself ready to issue the new stock to both Uncle Sam and Richmond-Anaconda stockholders. There will remain 200,000 shares in the treasury.

Gold Chain—Operations suspended a short time ago, on account of repairs to engines on the Mammoth high-line, have been resumed, at this, the Oponhongo and Mammoth mines. The output for the week ended Nov. 8 was 15 cars. New ore carrying copper with some silver and lead has been opened on the 500-ft. level.

Eagle & Blue Bell—There are two ore-bodies in this mine over 100 ft. apart, one carrying lead ore of good grade and the other gold and silver. These are reported on the 1350-ft. level, and the ore appears to be going down.

Salt Lake County

Ohio Copper—This company is milling from 100 to 2000 tons of ore daily. There are between 150 and 200 men working in mine and mill.

Michigan-Utah—This company's tramway has been repaired, and shipments down Little Cottonwood Cañon have been resumed.

Flagstaff—There is some talk of a consolidation of this Alta property with the Columbus Extension and the Columbus Consolidated. The properties adjoin, and might be operated through a drain and haulage tunnel, starting some distance down the cañon, which would eliminate all water difficulties.

Columbus Consolidated—This company, together with the Columbus Exten-

sion, is the defendant in a suit recently filed, alleging that these companies have extracted 25,000 tons of ore, valued at $500,000, from the Haskell claim, and three times this amount is asked.

Alta-Emerald—Work has been discontinued, on account of deep snow.

Iowa Copper—Work has been resumed at this property, in Big Cottonwood Cañon, and a contract for further development has been given.

Washington

Ferry County

Ben Hur—The shaft has been completed to the 500-ft. level and production has been resumed, ore being shipped from the second and fourth levels.

Swamp King No. 2—Work is to be resumed on this property in the Orient district. A 50-ft. shaft will be sunk.

Kittitas County

Cougar—This mine is being operated with two shifts of men, with satisfactory results. J. H. Barry, Swauck, is manager.

Okonogan County

Dividend—This property near Oroville, J. C. Fisher, manager, is now on a paying basis, and improvements are being planned.

Keller & Indiana Smelting Co.—The smeltery lands and water rights of this company were sold recently at public sale to H. J. Lefever and Jasper King, of the Walla Walla Mining Co.

Stevens County

Bornite Mining & Smelting Co.—A vein of ore assaying $6 per ton in gold and measuring two feet wide was struck recently on the 200-ft. level.

Blue Star—Mark Mitchell, operating this property under lease, will install a pump to unwater the shaft.

Imperial—Operations have been discontinued for the rest of the winter, to be resumed in March when sinking of a 300-ft. shaft will be begun.

Montezuma—Portland men are planning to resume operations on this property this month.

First Thought—Plans are being made for a mill and cyanide plant of 100 tons capacity, and construction work will be begun next month.

Aurora Copper Mining Co.—The property of this company, in the Chewelah district, is to be thoroughly developed by Spokane and Seattle men. An order has been placed by Conrad Wolfle, president and manager, for a compressor. Orders have been issued for a concentrator and a short tramway. The plant and its accessories will cost $40,000. It is proposed to have the mine ready for making shipments by spring and the mill producing concentrates in July.

Canada

British Columbia

Ore production in the Kootenai and Boundary districts totaled 51,041 tons, for the week ended Nov. 9, making a total for the year to date of 2,162,902 tons. Smeltery receipts for the week were 44,756 tons; for the year 1,939,934 tons. The Lucky Jim mine at Bear Lake shipped 213 tons of high-grade ore and the Standard shipped 140 tons of zinc concentrates. Ore production and smelter receipts in detail were: Rossland, week, 1805 tons; year 209,141 tons; Nelson production, week, 1805 tons, year 60,958 tons; Boundary, production, week, 41,301, year, 1,753,165; Slocan, production, week, 2278 tons, year, 101,704; East Kootenai, production, week, 496 tons, year, 38,294; British Columbia Copper Co., Greenwood, week, 15,008 tons, year, 575,143 tons; Granby smeltery, from Grand Forks, week, 24,214 tons, year, 1,091,975 tons; Consolidated company, Trail, smeltery receipts, week, 5534 tons, year, 272,816 tons.

Payne—Three shifts of miners are driving a deep tunnel with machine drills on this mine, in the Sandon district. The tunnel will be driven to cut an orebody that yielded well on the upper levels.

Last Chance—Eight feet of gold and copper ore has been struck in this mine four miles north of Rossland; Hugh McQuade and Earnest McQuade owners. After prospecting the surface they sunk a shaft to a depth of 70 ft., using a gasoline hoist. The ore is regarded as of a concentrating grade. Development will be started in the spring.

Granby—The net earnings for October were $145,000 as compared with $181,000 for September. Despite the decrease in October it is stated that the earnings of that month were above the same month of last year.

Ajax—Reports are circulating in Kaslo that a strike of high-grade galena has been made on this mine at Ferguson Camp.

Hidden Creek—The directors have authorized F. M. Sylvester, acting general manager, who is now in Vancouver, to call for bids at once for the construction of a smeltery, at Granby Bay, Observatory Inlet, Portand Canal district, as well as for all the machinery and equipment. The mine is owned by the Granby Consolidated Mining, Smelting & Power Co. It is the intention of the company to have the smeltery ready by the end of 1913. It will have a capacity of 2000 tons daily. The equipment will comprise three blast furnaces and converters. Custom ores will be treated, and in order to encourage other branches of the mining industry, it has been decided to install a lead furnace for handling custom silver-lead ores shipped from the Hazelton district. The program calls for the expenditure of about $1,750,000.

Ontario Cobalt

Shipments of ore and concentrates, in tons, from Cobalt for October, 1912, were:

Bailey	21.57
Buffalo	95.09
Chambers-Ferland	65.50
Cobalt Lake	123.74
Cobalt Townsite	285.33
Coniagas	158.39
Crown Reserve	37.12
Hudson Bay	30.85
Kerr Lake	90.95
La Rose	251.17
Lost & Found	17.80
McKinley-Darragh	296.77
O'Brien	107.32
Penn-Canadian	31.25
Tretheway	66.25
Timiskaming	96.51
	1,775.61

Lumsden—A pocket of rich ore has been struck on the 200-ft. level.

Penn-Canadian—A new vein, carrying high-grade ore has been discovered on the 285-ft. level.

Seneca - Superior — Shipments have started from this Peterson Lake lease. The ore in the face is about 14 in. wide, and is high grade.

Cochrane—A pipe line is being extended to this property from the Timiskaming to supply air for the drills, and as soon as this work is completed, underground work will be begun on contract by Robert Perew and David Raney.

Hitchcock—This property has passed into the hands of a Buffalo syndicate.

General Mines Co.—This company, recently organized, has taken over the Green-Meehan power plant, from which it will furnish air to the drills operating on the Red Rock.

Casey-Cobalt—David Roberts, mine captain and Charles Lundburg, miner, were drowned at this mine, Nov. 10. They were overcome by gas in a winze and fell into 4 ft. of water at the foot of the workings.

Nipissing—Ten stamps of the new low-grade mill have been put in operation.

Ontario-Porcupine

Hollinger—Diamond-drilling operations from the 300-ft. level are stated to have resulted in finding rich ore at depth. Another dividend of 3% for the four weeks ended Nov. 20 has been declared.

Dome Lake—The vein has been cut at the 180-ft. level, showing two feet of good ore.

Delora Mohawk—A contract has been let for sinking a 100-ft. shaft.

Quebec

Raleigh—This gold property, comprising 1000 acres, in Dudswell and Westbury Townships, in Wolfe and Compton Counties, has been acquired by a Montreal syndicate, headed by D. Lorne McGibbon. Two shafts are being worked with good results and further development is being planned.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

Coal Trade Review

New York, Nov. 20—The coal markets in the West continue active, with transportation as a controlling factor. Car supply continues poor. The Lake trade is approaching its close for the season, but still takes a good many cars.

The seaboard bituminous trade is in better condition, but there is a demand for coastwise shipments which is not fully satisfied.

There is still complaint of slow deliveries in the anthracite trade. They are really behind, though not to the extent that retail dealers represent to customers for their own profit. It is doubtful whether the shortage can be made up by the end of the year.

Coal passing through the Sault Ste. Marie canals season to Nov. 1, short tons:

	1911	1912	Changes
Anthracite	1,769,567	1,682,355	D. 87,212
Bituminous	11,894,878	10,937,049	D. 957,829
Total	13,664,445	12,619,404	D.1,045,041

The total decrease was 7.6% this year, indicating that heavy shipments are needed for the rest of the season.

German Foreign Trade—Exports and imports of fuel in German Empire, nine months ended Sept. 30, metric tons:

	Exports	Imports	Excess
Coal	23,415,270	7,421,865	Exp. 15,993,405
Brown coal	39,788	5,397,183	Imp. 5,357,395
Coke	4,179,116	439,483	Exp. 3,739,633
Briquettes	2,000,724	126,752	Exp. 1,873,972
Total	29,634,898	13,385,283	Exp. 16,249,615
Total, 1911	24,901,847	13,781,324	Exp. 11,120,523

Exports this year included 24,768 tons coke to the United States.

United States Coal Imports—Imports of coal and coke into the United States, nine months ended Sept. 30, long tons:

	1911	1912	Changes
Anthracite	20	1,030	I. 1,010
Bituminous	928,311	1,185,634	I. 257,323
Coke	55,958	69,572	I. 13,614
Total	984,289	1,256,236	I. 271,947

Canada furnished this year 1,050,394 tons of coal and nearly all the coke; Australia, 108,925 tons of coal; Japan, 20,228 tons.

United States Fuel Exports—Exports of coal and coke from the United States, with coal furnished to steamships in foreign trade, nine months ended Sept. 30, long tons:

	1911	1912	Changes
Anthracite	2,625,582	2,601,631	D. 23,951
Bituminous	10,124,872	10,983,293	I. 858,421
Coke	722,621	618,450	D. 104,171
Bunker coal	5,012,097	5,435,719	I. 483,622
Total	18,485,172	19,699,093	I. 1,213,921

The bunker coal is practically all bituminous. Canada took this year 10,317,787 tons of coal; Cuba and the West Indies, 1,358,013 tons; Panama, 362,277 tons; Mexico, 239,402 tons.

Iron Trade Review

New York, Nov. 20—The iron and steel trades continue in the same condition of active demand as for several weeks past. There has been little change in prices, though in some lines premiums for early delivery are called for.

Instead of the close approach of winter easing off the demand upon the mills for delivery of finished steel, the pressure has, on the whole, increased, though, of course, in certain lines, such as structural shapes and wire products, there is somewhat less pressure. In plates the increased demand for car purposes more than makes up for the seasonal decline in requirements for outside work. An inquiry for a round lot of a common size of flat merchant bars developed offers from some Pittsburgh mills to ship in five months, from others to ship in five or six, while some mills suggested eight or ten months, disclosing an unprecedented condition in this community.

Prices of the important steel products are nominally unchanged, so far as the large mills are concerned, but these prices now involve nothing but delivery far ahead. For early deliveries larger premiums are being paid, but, as a rule, buyers cannot afford to pay premiums, and thus there is little being done in prompt or early-delivery material.

The scarcity in billets and sheet bars, which seemed to have reached the possible limit several weeks ago, has grown still more acute. Prices are nominally about 50c. higher than a week ago, but practically there is no general market, as there are only occasional offerings. While the Eastern mills are occasionally selling steel for far forward delivery, the Pittsburgh and Valley mills are quoting no billets or sheet bars for next year, although there is urgent inquiry.

Pig-iron sales have been heavy, though not quite up to the October mark. There is a tendency to place larger contracts, and prices on such orders are advancing steadily.

Baltimore

Nov. 18—Exports for the week included 40,000 lb. of scrap to Leith, Scotland; 2,163,880 lb. of steel billets and 950,320 lb. sheet bars to Liverpool. Imports included 9451 slabs spelter, 3995 tons ferromanganese and 60 tons ferrosilicon from Middlesboro, England; 6600 tons manganese ore from Bombay, India, and 6000 tons from Batum, Russia; 6543 tons pyrites from Huelva, Spain; 12,150 tons iron ore from Cuba.

Birmingham

Nov. 18—Sales of pig iron for delivery during the second quarter of 1913 have been made by Southern iron manufacturers on a basis of $15 per ton, No. 2 foundry. There is a steady inquiry and the indications point to the aggregate business transacted by the end of the year caring for a large proportion of the probable make in that period. The furnaces in operation in the South, with one or two exceptions, are in good shape and promise to keep up the output that was set during October. By the end of the year, if there is no interruption in the steady trade, the yard stocks of iron will be at the minimum for the past four years. No further advance in pig-iron quotations is now being mentioned and $15 appears to be the maximum. There is a healthy home consumption, and a better demand from foundries throughout the South.

Steel prices are stronger and advances are anticipated before long in some of the shapes. Rails are being sold largely. There is also a healthy demand for fabricated steel, in steel-wire goods and in other shapes.

Cast-iron pipe prices have strengthened lately, manufacturers keeping apace with the iron quotation. Much pipe continues moving to the West.

As to sales of pig iron the Tennessee Coal, Iron & R.R. Co., the Sloss-Sheffield Steel & Iron Co. and the Woodward Iron Co. in particular are reported as having booked some splendid business for delivery during the first half.

Chicago

Nov. 19—The local iron market is unmarked by any great change; the demand for iron and steel products of all kinds continues large, with difficulty in supplying it. Pig iron continues in steady demand, with $14 the minimum on Southern No. 2 at Birmingham, which means $18.35 Chicago, and a good percentage of the sales running 50c. higher. Northern No. 2 brings $17.50@18 at the furnace, which means $18@18.50 delivered.

In general the furnaces are well sold up to the end of the first quarter and their representatives are not worried about future business. It is coming and will come, they say, without the need of their cutting prices unnecessarily or running after melters. Indeed it seems to be coming, gradually and surely; while the average melter is buying small lots often, he is looking more anxiously to the needs of the second quarter and later than the seller.

Beyond the first half there is yet no demand, through inquiries continue. Tariff talk undoubtedly influences some users of pig iron; others are cautious from force of habit incalculated by the experience of the last few months. They see ahead of their business requirements large needs of material, at the worst outlook; they show, in general, no apprehension of anything that will injure business.

Iron and steel products continue to be in large demand, the only falling off being in structural materials, naturally in less demand at this season. Railroad supplies are much sought, with trouble only about deliveries. Bar business continues large and prices are firm; for plates, sheets and minor lines the demand is steady and manufacturers are pressed for deliveries. All signs in the general conditions of business point to large and continued use of all forms of iron and steel products.

Cleveland

Nov. 18—Weather has continued good for Lake navigation. Ore shipments from docks are still delayed by shortage of cars.

Pig Iron—The market has been strong, but not especially active. Quotations, Cleveland delivery, are $17.90 for bessemer, $17@17.25 for basic, $17.25@18 for No. 2 foundry and $19.25@19.75 for Lake Superior charcoal.

Finished Material—Deliveries are a little better. New contracts coming in are for longer periods. The heaviest demand just now is for bars and plates.

Philadelphia

Nov. 20—In the pig-iron market inquiries are numerous, chiefly for next year. Sellers are holding prices firmly and no concessions are in sight. Stocks are entirely cleaned out. More furnaces would blow in, if the coke question was not in the way. Quotations are for No. 2X foundry $18.50; No. 2 plain, $18; gray forge is $17.75; basic $18.50 and low phosphorus $24 per ton.

Billets—Openhearth billets are nominally $32, but are hard to get, even at premiums.

Bars—The bar mills are crowded. Iron bars are 1.75c. and steel bars 1.85c. for any sort of seasonable delivery.

Sheets—Pressure for sheets is strong, and premiums are offered for deliveries wanted.

Pipes and Tubes—A good volume of business is being done and there is complaint of slow deliveries.

Plates—The demand is still active and early deliveries cannot be had from the mills.

Structural Material—Demand is off a little, as usual at this season. New orders are for shipyard and bridge work.

Scrap—Prices are firmly held. This week sales have been in small lots, but dealers are not worrying.

Pittsburgh

Nov. 19—The pig-iron market in the Central West is again showing an advancing tendency, with sales of perhaps 100,000 tons of bessemer and basic, a part of the tonnage being at advances of 25c., with prospects that additional sales will be made at further advances. Malleable and foundry grades have also turned very strong. The stiffness in the market is due partly to purchases by large steel companies and partly to the continued strength in coke. While prompt coke is off a trifle, sales being made at $3.90 and $4, Connellsville ovens, for prompt shipment, the inevitable scarcity at holiday time, and sales for December shipment have been made at $4.25 and $4.35. For the new year, sales aggregating 15,000 tons a month or more have been made over first half at $3.50, while at least one contract has been made at $3.25 for the whole year. Such a position in coke naturally prompts furnaces to ask more money for pig iron.

Rivets have been advanced $2 a ton, to 2.10c. for buttonhead structural rivets and 2.20c. for conehead boiler rivets. The total advance in rivets from last spring's low point is $9 per ton. At prices now quoted, deliveries can be made in 30 to 60 days, while out of jobbers' stocks sales are made at still higher prices for prompt shipment.

Pig Iron—The Jones & Laughlin Steel Co. has purchased 12,000 tons of bessemer iron at $17, Valley, for early delivery, and 30,000 tons at $17.25, Valley, for first-quarter delivery. It is understood that other transactions have been practically closed for bessemer at $17.25, Valley, and that furnaces will offer no more at less than $17.50. The Jones & Laughlin Steel Co.'s recent purchase of 10,000 tons of basic pig was incorrectly reported at $16, the price actually paid being on the basis of $16.25, Valley. Additional sales have been made at this price, and $16.50 has since been paid. At the moment it is doubtful whether $17.25 on bessemer or $16.25 on basic can be done again. Foundry iron has proved very stiff, some buyers having been forced to pay as high as $17.50, Valley, for brands desired, and malleable has also advanced. We quote: Bessemer, $17.25@17.50; basic, $16.25@16.50; No. 2 foundry and malleable, $17@17.50; forge, $16.50@17, f.o.b. Valley furnaces, 90c. higher delivered Pittsburgh.

Ferromanganese—The scarcity of ferromanganese is growing more and more acute, nearly all consumers being short, while only occasional lots of prompt can be secured. Contract material is quoted at $61, Baltimore, but it is difficult to put contracts through. Prompt material is quotable nominally at $71@75, Baltimore, with $1.95 freight to Pittsburgh, but is not always obtainable within this range.

Steel—Sales of either billets or sheet bars are very rare and the market is quotable only approximately, although it is certainly 50c. higher than a week or ten days ago. The large mills are entirely out of the market, having absolutely nothing to offer for any early delivery, while they are so crowded that they state they cannot even see their way clear to sell for first-quarter delivery. Occasionally they promise a favorite customer that they will sell a limited tonnage for first-quarter if they can develop later that they will be able to spare it. Brokers have some steel, but they are very reserved about naming prices. There is much inquiry, but usually negotiations do not go as far as the quoting stage. We quote as approximately representing the minimum of the market: Bessemer billets, $27; sheet bars, $27.50; openhearth billets, $28; sheet bars, $28.50, f.o.b. maker's mill, Pittsburgh or Youngstown. Rods are $30, mill.

Sheets—Specifications continue to crowd upon the sheet mills, these being largely upon old contracts made at much below present prices. Much of this business will involve delivery next year, and the average price of shipments is thus much below the present market. On the other hand, many sales for prompt delivery, which means any time this year, are being made at $2 above the regular minimum for black sheets, and $2 to $4 above for galvanized sheets. The mills which have been free sellers are fully sold up for first-quarter and fairly well for second quarter. Frequently sales are made even for next year at premiums over the regular market. Regular prices, upon which the premiums mentioned are figured, are: Black sheets, 28 gage, 2.25c.; galvanized, 28 gage, 3.40c.; blue annealed, 10 gage, 1.65c.; painted corrugated, 2.45c.; galvanized corrugated, 3.45c. per pound.

Nov. 20 (By Telegraph)—Additional sales are reported today of bessemer pig at $17.25, Valley, and basic at $16.50, Valley, which is now the market.

Lake Superior ore selling began today, with sales totaling 4,000,000 tons. Prices are $4.40 for Old Range and $4.15 for Mesabi bessemers; $3.60 for Old Range

and $3.40 for Mesabi nonbessemers. These prices are 65c. higher than this season for bessemers and 55c. on nonbessemers; but are 10c. below 1911 prices.

St. Louis

Nov. 18—The pig-iron market is still active, though the volume of business is decreasing, more because most producers are sold up than for lack of buyers. Prices remain unchanged at $14@14.50, Birmingham, or $17.75@18.25, St. Louis, for No. 2 foundry. Northern iron is in good demand and is quoted at $18.50@19, St. Louis.

The demand for steel cars and railroad supplies as well as steel specialties of all kinds continues to gain strength.

Coke is getting scarcer as the season advances. This is due to car and labor shortage, and also to the large amounts of coke being used for domestic purposes this year on account of the anthracite shortage. Connellsville foundry is quoted at $6.50 and byproduct coke at $5.50@6, St. Louis.

Iron Ore Trade

Of the shipments of 7,010,219 tons of Lake Superior iron ore in October, a total of 5,913,493 tons, or 84.4%, was delivered to Lake Erie ports.

Foreign Iron Trades

British Foreign Trade—Exports and imports of iron and steel and of machinery in Great Britain, nine months ended Sept. 30, as valued by the Board of Trade returns:

	Exports	Imports	Excess
Iron and steel	£34,549,271	£9,232,320	Ex. £25,316,951
Machinery...	24,056,385	4,995,829	Ex. 19,060,556
Hardw're, etc.	9,130,207	5,956,963	Ex. 3,173,244
New ships....	4,433,042	.....	Ex. 4,433,042
Total..... ..	£72,168,905	£20,185,112	Ex. £51,983,793
Total, 1911..	65,703,649	17,377,974	Ex. 48,325,675

Increase in exports, £6,465,256; increase in imports, £2,807,138. The quantities of iron and steel were, in long tons:

	1911	1912	Changes
Exports	3,277,330	3,537,835	I. 260,505
Imports	1,297,988	1,432,757	I. 134,769

Exports of tinplates to the United States decreased from 12,780 tons in 1911 to 1430 tons this year.

British Pig Iron Prices—Recent quotations for pig iron in England are: Middlesboro pig, $16.11; Scotch pig, $17.55; West Coast hematite (bessemer), $19.50 per ton.

Metal Markets

New York, Nov. 13—The metal markets have been generally steady, with some tendency to advance.

In our table of prices last week the quotation for spelter in New York on Nov. 11, 12 and 13 was given as 7.40@7.50c., through a clerical error. It should have been 7.40@7.45c. on each day.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold			
Sept. 1912..	$ 568,302	$ 4,200,682	Imp. $3,632,380
" 1911..	2,352,861	4,704,096	Imp. 2,351,235
Year 1912..	43,728,274	38,789,793	Exp. 4,938,481
" 1911..	18,263,310	45,177,106	Imp. 26,913,796
Silver			
Sept. 1912..	6,011,221	3,648,883	Exp. 2,362,338
" 1911..	4,940,391	4,161,706	Exp. 778,685
Year 1912..	52,347,946	36,301,752	Exp. 16,046,194
" 1911..	49,527,961	33,696,430	Exp. 15,831,531

Exports from the port of New York, week ended Nov. 16: Gold, $100; silver, $1,210,623, chiefly to London. Imports: Gold, $180,108; silver, $208,280, from the West Indies, Mexico and South America.

Gold—Prices on the open market in London remained at the usual level, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. Supplies arriving went to the Bank of England, with the exception of a small reservation for India.

Iridium—This metal is still quoted at $67@70 per oz., New York.

Palladium—Supplies are still rather scarce, and $72 per oz. is quoted.

Platinum—The market seems to be improving, but prices are unchanged. Dealers here continue to ask $45.50 per oz. for refined platinum and $48 per oz. for hard metal, up to 10% iridium.

Our Russian correspondent writes, under date of Nov. 8, that the market and prices are generally unchanged. The demand, especially from abroad, has become better. The starateli begin to reduce work, as the frosts have set in. The offer of platinum by the starateli will diminish from now on and this will make the market steadier. The quotations are: in St. Petersburg, 37.500@37,700 rubles per pood; at Ekaterinburg, 9.80 rubles per zolotnik, for crude metal, 83% platinum—equal to $36.85 per oz. in both cases.

Silver—The market continues steady. Every decline below 29d. is followed by an advance to the even figure, so that any large demand upon the market would put price up to the figures prevailing some weeks ago.

SILVER AND STERLING EXCHANGE

Nov.	14	15	16	18	19	20
New York....	62¾	62⅛	62¾	62⅞	62⅛	62¾
London.....	29	28⅞	29	29 1/16	28 15/16	29
Sterling Ex..	4.8500	4.8495	4.8505	4.8510	4.8495	4.8455

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver. 0.925 fine.

Exports of gold from London to British India 10 months ended Oct. 31 were £7,998,817 in 1911, and £10,947,463 in 1912; an increase of £2,948,646 this year.

Copper, Tin, Lead and Zinc

NEW YORK

Nov.	Copper: Lake, Cts. per lb.	Copper: Electrolytic, Cts. per lb.	Tin: Cts. per lb.	Lead: New York, Cts. per lb.	Lead: St. Louis, Cts. per lb.	Zinc: New York, Cts. per lb.	Zinc: St. Louis, Cts. per lb.
14	17⅝ @17¾	17.30 @17.40	50⅜	4.60 @4.65	4.45 @4.50	7.40 @7.45	7.25 @7.30
15	17⅝ @17¾	17.35 @17.45	50¼	4.60 @4.65	4.45 @4.50	7.40 @7.45	7.25 @7.30
16	17⅝ @17¾	17.45 @17.50	50⅛	4.60 @4.65	4.45 @4.50	7.40 @7.45	7.25 @7.30
18	17⅝ @17¾	17.45 @17.50	50	4.57½ 4.62½	4.42½ @4.47½	7.40 @7.45	7.25 @7.30
19	17⅝ @17¾	17.45 @17.50	49⅞	4.57½ 4.62½	4.42½ @4.47½	7.40 @7.45	7.25 @7.30
20	17⅝ @17¾	17.45 @17.50	49⅝	4.57½ 4.62½	4.42½ @4.47½	7.40 @7.45	7.25 @7.30

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. and that for casting copper usually about 0.125 to 0.2c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

Nov.	Copper: Spot	Copper: 3 Mos	Copper: Best Sel'td	Tin: Spot	Tin: 3 Mos	Lead, Spanish	Zinc, Ordinaries
14	78	78¼	84	229¾	229¾	18¼	26⅞
15	78¼	79	84	229¾	229¾	18	26⅞
16	....	....	....	.....	.....	....	....
18	78⅛	79¼	84¼	228¾	228¾	18⅛	26⅛
19	77 11/16	78⅛	83¾	227¼	227½	18⅛	26⅛
20	78	78¼	83¾	226½	226⅛	18⅛	26⅛

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26c.; £25 = 5.44c.; £70 = 15.22c. Variations, £1 = 21¾c.

Copper—Beginning on Nov. 21 there was an improvement in the demand for copper and transactions were effected upon a rising scale of prices, but there has been no snap to the market. The situation appears to be that buyers have been starved into paying the price asked by the principal producers, but do so grudgingly and for no greater quantities than absolutely necessary. American consumers have not yet figured in the market to any important extent, but some millions of pounds of electrolytic copper

have been sold to Europe at prices rising to 17.45@17.50c., cash, New York, or the equivalent c.i.f. Owing to the increase in ocean freight charges and the present low rate of exchange European sales net relatively less than they did a little while ago. Some small sales of Lake copper were made during the week at 17⅝@17¾c., cash, New York.

The buying by European consumers this week evidently indicates that their stocks are being depleted. The statistics of public stocks for the first half of November show a decrease of 1764 tons. Those for the second half of October had showed a decrease of 2383 tons. The purchases of this week were principally for early shipment. While there has been but little demand on the part of domestic consumers, it is generally supposed that they are not well covered and that they are likely to come into the market at any time. At the close, we quote Lake copper at 17⅝@17¾c., and electrolytic copper in cakes, wirebars and ingots at 17.45@17.50c. Casting copper is quoted nominally at 17.25@17.35c. as an average for the week.

The London market for standard copper has been more active, and transactions were of larger volume. The market advanced from £78 for spot and £78 15s. for three months on Nov. 14 to £78 10s. for spot and £79 5s. for three months on Nov. 18. It closes slightly lower at £78 for spot, and £78 15s. for three months.

Visible stocks of copper in Europe, Nov. 15, are reported as follows: Great Britain, 27,430; France, 6870; Rotterdam, 350; Hamburg, 1930; afloat from Chile, 2130; afloat from Australia, 4850; total, 43,560 long tons, or 97,574,200 lb. This is a decrease of 2780 tons from the Oct. 31 report.

Tin—The market in London developed a weaker tone, which for the want of other argument, was ascribed to the expected increase in statistics. Business continued in a desultory fashion, but in most cases was limited to small transactions. Support from this side seemed to be entirely lacking, the fact being that sellers in this market, rather than replenish their supplies, were anxious to liquidate, and in consequence sold below London limits. Business here continues in a hand-to-mouth fashion. The market closes weak at £226 5s. for spot, and £226 10s. for three months, and at about 49⅝c. for December tin.

Lead—The card price of the A. S. & R. Co. remains 4.75c., New York, but the open market is entirely in the hands of the outsiders, several of whom have steadily lowered their offers in the endeavor to interest buyers. Not only does the supply of lead seem to have increased, the advent of the International company having been a disturbing factor, but also the consumptive demand seems to have relaxed, which, perhaps, is only natural in view of the approach of winter when much out-of-doors work is suspended. At the close lead at St. Louis is quoted at 4.42½@4.47½c., and 4.57½@4.62½c. at New York.

The London market for Spanish lead is unchanged at £18 2s. 6d., and English 2s. 6d. higher.

Spelter—The market has been rather sluggish and transactions have been confined to November-December deliveries, the bulk of the business reported having been at 7.25@7.30c., St. Louis. January spelter has been offered at 7.20c., and less; but nobody has been interested in such contracts. A good deal of uncertainty respecting the market for this metal is manifested. At the close we quote 7.25@7.30c., St. Louis, and 7.40@7.45c., New York.

The foreign market is slightly lower, good ordinaries being quoted at £26 10s., and specials at £26 15s. per ton.

Base price of zinc sheets is $9 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8% discount.

Zinc dust is quoted 7¼c. per lb., New York.

It is reported that the Vieille Montagne company is making such increases in the capacity of some of its smelteries that its annual output hereafter will be about 120,000 metric tons of zinc per annum.

Other Metals

Aluminum—The market has been rather dull and prices are a little easier, current quotations being 26@26½c. for No. 1 ingots, New York. A report comes from abroad that the Aluminum Co. of America is buying up all surplus available for export in France and Germany.

Antimony—Business is quieter and the market is not so active as it has been. Prices are easier, on account of some liquidating sales. Cookson's is quoted at 10.20@10.50c. per lb., and Hallett's 9.60@9.75c. For Chinese, Hungarian and other outside brands 9@9.35c. is asked.

Quicksilver—Business has been steady and there are no changes in prices. New York quotations are $42 per flask of 75 lb., with 60c. per lb. asked for retail lots. San Francisco, $41.50 for domestic orders and $39 for export. London price is £7 12s. 6d. per flask, with £7 10s. named from second hands.

Zinc and Lead Ore Mareets

Joplin, Mo., Nov. 16—The high price of zinc-sulphide ore is $60, the base range $52@57 per ton of 60% zinc. Zinc silicate sold at $30@33 per ton of 40% zinc. The average price for all grades of zinc is $52.84. Lead sold on a base of $57 per ton of 80% metal, with but two lots assaying over 80%. The average price of all grades of lead is $56.34 per ton.

Weather conditions have been superb all fall for the outputting of ore, and the shipments have been heavy, rounding out the period with a shipment of over 8000 tons this week.

SHIPMENTS WEEK ENDED NOV. 16

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	5,931,080	.....	1,148,210	$195,253
Joplin	3,226,340	.....	323,720	99,463
Alba-Neck	1,011,520	.....	44,300	30,068
Duenweg	967,700	.....	59,450	29,274
Galena	930,110	.....	60,820	27,210
Granby	231,750	803,480	14,030	20,215
Oronogo	699,520	.....	84,820	17,603
Spurgeon	311,410	310,450	27,870	14,155
Miami	329,590	.....	87,680	10,410
Cave Springs	305,540	.....	4,540	8,687
Carl Junction	232,710	.....	.....	6,748
Jackson	181,280	.....	12,200	5,236
Carthage	121,390	.....	.....	3,377
Aurora	157,440	80,000	.....	4,216
Lawton	65,200	.....	.....	1,790
Sarcoxie	63,380	.....	.....	1,647
Stott City	49,590	.....	.....	1,240
Totals	14,815,550	1,193,930	1,867,640	$475,592
46 weeks	499,425,480	31,462,750	83,062,570	$16,241,611

Blende val., the week, $402,780; 46 weeks, $13,373,412
Calamine, the week, 20,187; 46 weeks, 498,647
Lead value, the week, 52,625; 46 weeks, 2,369,552

MONTHLY AVERAGE PRICES

Month	Zinc Ore: Base Price		Zinc Ore: All Ores		Lead Ore: All Ores	
	1911	1912	1911	1912	1911	1912
January	$41.85	$44.90	$40.55	$43.54	$55.68	$58.92
February	40.21	45.75	39.16	43.31	54.46	52.39
March	39.85	51.56	38.45	49.25	54.57	54.64
April	38.88	52.00	37.47	50.36	56.37	54.18
May	38.25	55.30	36.79	53.27	55.21	52.45
June	40.50	55.88	38.18	54.38	56.49	55.61
July	40.75	58.85	38.36	56.59	58.81	58.83
August	42.50	55.13	41.28	53.27	60.74	57.04
September	42.63	59.75	41.29	57.07	59.33	61.26
October	42.38	57.00	40.89	55.97	54.72	63.21
November	45.40	.....	43.25	.....	57.19	.....
December	44.13	.....	40.76	.....	62.03	.....
Year	$41.45	.....	$39.90	.....	$56.76	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Platteville, Wis., Nov. 16—The base price paid this week for 60% zinc ore was $54@55 per ton. The base price for 80% lead ore was $58 per ton.

SHIPMENTS WEEK ENDED NOV. 16

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Mineral Point	834,470	.....	.....
Platteville	661,780	.....	198,000
Benton	659,640	.....	955,200
Shullsburg	314,800	.....	.....
Cuba City	240,400	.....	81,000
Hazel Green	240,000	.....	.....
Galena	232,900	.....	.....
Linden	52,000	.....	.....
Total	3,235,990	.....	1,234,200
Year to date	176,262,170	7,218,960	33,413,410

Shipped during week to separating plants, 1,688,380 lb. zinc ore.

Other Ore Markets

Manganese Ore—The price for domestic ores as fixed by large buyers, is 25c. per unit for manganese and 5c. per unit for iron content, for a base ore containing 49% or over in manganese, not

over 0.20 phosphorus and 8% silica. Prices range down to 23c. per unit for 40% manganese; with deductions for excess phosphorus and silica.

New Caledonia Ores

Exports of ores from New Caledonia, eight months ended Aug. 31, as reported by the *Bulletin du Commerce*, of Noumea, were 46,555 metric tons of nickel ore and 31,261 tons chrome ore. Exports of metals were 2000 tons of nickel matte.

Chemicals

New York, Nov. 20—General trade continues good and the markets are fairly active.

Arsenic—Supplies are better and business has been quiet. The market is easier, but quotably unchanged, $5@ 5.12½ per 100 lb. being asked for spot and $4.62½ for futures.

Copper Sulphate—Trade is fair and the market is steady. Prices are unchanged at $5.50 per 100 lb. for carload lots, and $5.75 per 100 lb. for smaller parcels.

Nitrate of Soda—The market is quiet and buyers are rather holding off. Quotations are 2.60c. per lb. for all positions up to May; 2.57½c. for later deliveries.

Phosphate Rock—Shipments of Florida phosphates, nine months ended Sept. 30, are reported as below, in long tons:

	1911	1912	Changes
Hard rock	342,689	351,726	I 9,037
Pebble	1,017,593	977,035	D. 40,558
Total	1,360,282	1,328,761	D. 31,521

Exports have been checked to some extent by high ocean freights.

Petroleum

Exports of mineral oils from the United States, nine months ended Sept. 30, were 1,348,222,381 gal. in 1911, and 1,407,544,164 gal. in 1912; an increase of 59,321,783 gal., or 4.4%, this year.

The monthly report of the *Oil City Derrick* shows new wells completed in the month of October as follows: Pennsylvania, New York and West Virginia, 534; Lima-Indiana, 59; Kentucky, 10; Illinois, 146; Kansas-Oklahoma, 739; Texas-Louisiana, 145. In all the divisions 1633 wells were completed, having a new production of 57,857 bbl. This was an increase of 108 in the number of wells and a decrease of 3371 bbl. in new production. Of the new wells 276 were failures, and 167 were gas producers. The number of oil-producing wells was 1190. In September the productive wells numbered 1108, 1272 in August and 1092 in July. At the close of October there were 519 rigs up and 1644 wells drilling, a total of 2163. These figures show a decrease of 60 in rigs, an increase of 180 in wells drilling, and a net increase of 120. The most of the new work is found in the Mid-Continent field.

Mining Stocks

New York, Nov. 20—On Nov. 14 there was some improvement on the Exchange. On the Curb mining stocks were more active, with heavy sales of Gold Hill and Stewart, and fair dealings in Cobalts. Braden was again prominent among the coppers.

Nov. 15 the market was under pressure and prices rather weak. On the Curb coppers were active and firm and there were fair sales of other mining stocks, including Goldfields and Cobalts. There was a sale of Comstock Tunnel at 10c. per share.

Nov. 1 the Exchange was uneasy and rather irregular. The Curb was fairly active with free sales of Goldfield Midway and some other stocks; also of Braden Copper.

Nov. 18 the Exchange was irregular and confused on a market almost purely professional. On the Curb there was fair trading in all the mining stocks at fractional declines.

Nov. 19 and 20 the Exchange continued irregular, the general tendency being rather weak. Mining stocks on the Curb were still in fair demand, but prices were unsteady, though changes were only small.

The listing committee of the New York Curb Market Association has listed and admitted to quotation the 600,000 shares of common stock, par value $5, of the Lightning Creek Gold Gravels & Drainage Co., Ltd., as a prospect. Stock outstanding, 600,000,, and in treasury, 200,000 shares.

At auction in New York, Nov. 14, eight shares Quicksilver Mining Co., preferred, $100 par, brought $7 per share; 100 shares Nipissing Mines Co., $5 par, $7.12½ per share.

Boston, Nov. 19—Aside from a few specialties the mining-share market has lapsed into dullness and with this same weakness. Granby Consolidated continued a conspicuous feature during the week, advancing to a high price of $77.75, or a $6.12½ bulge with some reaction. This is Granby's highest price for over two years. La Salle has come to the fore with a $2 advance during the week to $6.50. This is due to reports that the Calumet & Hecla management has decided to resume exploratory operations at the La Salle property.

Both Mayflower and Old Colony maintain strength and at times are fairly active. The former is up $1.75 to $15.25 and the latter $1.75 also to $10.25. These stocks were each selling at $2 per share a year ago. Calumet & Arizona and North Butte have been among the few active stocks. The first named rose $2 to $80 and the latter $1.50 to $38. Copper Range and Mohawk are also among the strong spots on increased dividend prospects. Quincy mining shares dis-

COPPER SMELTERS' REPORTS

This table is compiled from reports received from the respective companies, except in the few cases noted (by asterisk) as estimated, together with the reports of the U. S. Dept. of Commerce as to imported material, and in the main represents the crude copper content of blister copper, in pounds. In those cases where the copper contents of ore and matte are reported, the copper yield thereof is reckoned at 95%. In computing the total American supply duplications are excluded.

Company	August	Sept.	October
Alaska shipments.	1,242,836	1,726,715	1,435,235
Anaconda	25,250,000	24,500,000	25,250,000
Arizona, Ltd.	3,260,000	3,340,000	3,200,000
Copper Queen	8,040,424	9,103,861	8,184,575
Calumet & Ariz.	4,514,000	4,462,000	4,404,000
Chino	3,485,278	3,217,369	3,638,500
Detroit	1,882,289	1,881,668	1,934,828
East Butte	1,410,500	1,250,000	.....
Mammoth	1,802,590	1,834,937	.....
Giroux	774,844	1,005,208	.....
Mason Valley	1,384 000	1,200,000	1,563,700
Nevada Con.	6,551,030	5,607,578	.....
Ohio	620,000	635,000	.....
Old Dominion	2,597,896	2,204,000	2,523,000
Ray	2,902,715	2,978,404	.....
Shannon	1,400,000	1,142,000	1,210,000
South Utah	224,855	225,568	.....
United Verde*	2,500,000	2,750,000	.....
Utah Copper Co.	11,248,992	6,616,887	.....
Lake Superior*	21,000,000	19,250,000	21,500,000
Non-rep. mines*	8,195,156	8,094,792	8,250,000
Total production.	110,211,367	103,025,987	.....
Imports, bars, etc.	23,561,161	25,149,329	.....
Total blister	133,772,528	128,175,316	.....
Imp. in ore & matte	8,544,624	7,142,232	.....
Total American.	142,307,152	135,317,548	.....
Miami†	3,048,750	2,949,150	2,577,750
Brit. Col. Cos.:			
British Col. Copper	941,364	.....	1,013,000
Granby	1,970,388	2,083,118	.....
Mexican Cos.:			
Boleo†	.....	.....	2,612,400
Cananea	4,044,000	3,500,000	4,248,000
Moctezuma	3,229,839	771,844	3,045,667
Other Foreign:			
Cape Cop., S. Africa	.....	678,720	757,120
Kyshtim, Russia	1,400,000	1,750,000	.....
Spassky, Russia	902,720	981,120	.....
Tilt Cove, Newf'd	.....	.....	86,785
Exports from:			
Chile	8,512,000	6,048,000	8,512,000
Australia	8,064,000	7,616,000	9,520,000
Arrivals in Europe‡	20,200,320	8,518,720	13,771,520

†Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.

‡Does not include the arrivals from the United States, Australia or Chile.

STATISTICS OF COPPER.

Month	U.S.Refin'y Product'n	Deliveries, Domestic	Deliveries for Export
X, 1911	118,255,442	64,068,307	60,084,349
XI	111,876,601	68,039,776	67,049,279
XII	122,896,697	65,988,474	79,238,716
Year	1,431,938,338	709,611,605	754,902,233
I, 1912	119,337,753	62,343,901	80,167.904
II	116,035,809	56,228,368	63,148,096
III	125,694,601	67,487,466	58,779,566
IV	125,464,644	69,513.846	53.252,326
V	126,737,836	72,702,277	69,485,945
VI	122,315,240	66,146,229	61,449,650
VII	137,161,129	71,094,381	60,121,331
VIII	145,628,521	78,722,418	70,485,150
IX	140,089,819	63,460,810	60,264,796
X	145,405,453	84,104,734	47,621,342

VISIBLE STOCKS

	United States	Europe	Total
XI, 1911	134,997,642	176,825.600	311,823,242
XII	111,785,188	164,281,600	276,066,788
I, 1912	89,454,695	158,323,200	247,777,895
II	66,280,643	154,851,200	221,131,843
III	62,939,988	141,142,400	204,082,387
IV	62,367,557	136,819,200	199,186,757
V	65,066,029	134,176,000	199,242,029
VI	49,615,643	117,801,600	167,417,243
VII	44,335,004	108,186,000	152,521,004
VIII	50,280,421	113,299,200	163,579,621
IX	46,701,374	113,568,000	160,269,374
X	63,065,587	107,408,000	170,473,587
XI	76,744,964	103,801,600	180,546,564

counted the increase in the quarterly dividend rate to $1.50 by advancing $4 to $90 per share.

Prices on the Curb are about steady with the most pronounced activity in the cents stocks. Butte Central, after a $1.50 drop to $6.25, recovered to $7.75 again.

Assessments

Company	Delinq	Sale	Amt.
Alpha Con., Nev.	Nov. 13	Dec. 4	$0.03
Best & Belcher	Nov. 6	Nov. 25	0.05
Buffalo, Ida.	Oct. 28	Nov. 28	0.002½
Consolidated Virginia, Nev.	.....	.....	0.15
Crown Point, Nev.	Nov. 11	Dec. 4	0.10
Crown Point, Utah	Nov. 15	Dec. 10	0.01
Eastern Star, Ida.	Oct. 12	Nov. 12	0.003
Exchequer, Nev.	Oct. 30	Nov. 20	0.03
Franklin, Mich.	Oct. 18	.....	2.00
Laclede, Ida.	Nov. 18	Dec. 9	0.003
Holy Terror, Ida.	Oct. 18	Nov. 18	0.003
Hub, Ida.	Nov. 14	Dec. 14	0.001
Hugo, Ida.	Nov. 9	Dec. 9	0.001
Indiana, Mich.	Oct. 16	.....	1.00
Leroy Gold & Copper, Ida.	Nov. 28	Dec. 28	0.002
Mayflower, Ida	Nov. 27	Dec. 27	0.005
Melcher, Utah	Nov. 23	Dec. 12	0.02
National Copper, Ida.	Nov. 15	Dec. 10	0.01
North Star, Ida.	Nov. 30	Dec. 30	0.001
Oneco, Mich.	Oct. 10	.....	1.00
Ophir, Nev.	Nov. 11	Dec. 9	0.15
Rhode Island, Ida.	Oct. 31	Nov. 30	0.00½
Sierra Nevada, Nev.	.....	.....	0.10
Sunshine, Ida.	Oct. 30	Nov. 30	0.001
Tar Baby, Utah	Nov. 2	Dec. 2	0.002½
Yellow Jacket, Nev.	Oct. 30	Dec. 3	0.10

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1910	1911	1912	1910	1911	1912
January	52.375	53.795	56.260	24.154	24.865	25.887
February	51.534	52.222	59.043	23.794	24.081	27.190
March	51.454	52.745	58.375	23.690	24.324	26.875
April	53.221	53.325	59.207	24.483	24.595	27.284
May	53.870	53.308	60.880	24.797	24.583	28.038
June	53.462	53.043	61.290	24.651	24.486	28.215
July	54.150	52.630	60.654	25.034	24.286	27.919
August	52.912	52.171	61.606	24.428	24.082	28.375
September	53.295	52.440	63.078	24.567	24.209	29.088
October	55.490	53.340	63.471	25.596	24.594	29.299
November	55.635	55.719	.....	25.680	25.649	.....
December	54.428	54.905	.....	25.160	25.349	.....
Year	53.486	53.304	.....	24.670	24.592	.....

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	New York				London, Standard	
	Electrolytic		Lake			
	1911	1912	1911	1912	1911	1912
January	12.295	14.094	12.680	14.337	55.600	62.760
February	12.256	14.084	12.611	14.329	54.974	62.893
March	12.139	14.698	12.447	14.868	54.704	65.884
April	12.019	15.741	12.275	15.930	54.034	70.294
May	11.989	16.031	12.214	16.245	54.313	72.352
June	12.385	17.234	12.611	17.443	56.365	78.259
July	12.463	17.190	12.720	17.353	56.673	76.636
August	12.405	17.498	12.634	17.644	56.266	78.670
September	12.201	17.508	12.508	17.698	55.253	78.762
October	12.189	17.314	12.370	17.661	55.170	76.389
November	12.616	.....	12.769	.....	57.253	.....
December	13.552	.....	13.768	.....	62.068	.....
Year	12.376	.....	12.634	.....	55.973	.....

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1911	1912	Month	1911	1912
January	41.255	42.529	July	42.400	44.519
February	41.614	42.962	August	43.319	45.857
March	40.157	42.577	September	39.755	49.135
April	42.185	43.923	October	41.185	50.077
May	43.115	46.053	November	43.125	.....
June	44.606	45.815	December	44.655	.....
			Av. Year	42.281	.....

Prices are in cents per pound.

LEAD

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	4.483	4.435	4.334	4.327	13.009	15.597
February	4.440	4.026	4.266	3.946	13.043	15.738
March	4.394	4.073	4.238	4.046	13.122	15.997
April	4.412	4.200	4.262	4.118	12.889	16.331
May	4.373	4.194	4.223	4.072	12.984	16.509
June	4.435	4.392	4.292	4.321	13.260	17.588
July	4.499	4.720	4.397	4.603	13.530	18.544
August	4.500	4.569	4.406	4.452	14.260	19.655
September	4.485	5.048	4.356	4.924	14.744	22.292
October	4.265	5.071	4.139	4.894	15.332	20.630
November	4.298	.....	4.181	.....	15.821	.....
December	4.450	.....	4.332	.....	15.648	.....
Year	4.420	.....	4.286	.....	13.970	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	5.452	6.442	5.302	6.292	23.887	26.642
February	5.518	6.499	5.368	6.349	23.276	26.661
March	5.563	6.626	5.413	6.476	23.016	26.048
April	5.399	6.633	5.249	6.483	23.743	25.644
May	5.348	6.679	5.198	6.529	24.375	25.790
June	5.520	6.877	5.370	6.727	24.612	25.763
July	5.695	7.116	5.545	6.966	25.006	26.174
August	5.953	7.028	5.803	6.878	26.801	26.443
September	5.869	7.454	5.719	7.313	27.750	27.048
October	6.102	7.426	5.951	7.276	27.256	27.543
November	6.380	.....	6.223	.....	26.795	.....
December	6.301	.....	6.151	.....	26.849	.....
Year	5.758	.....	5.608	.....	25.281	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1911	1912	1911	1912	1911	1912
January	$15.90	$15.12	$14.40	$13.32	$14.75	$14.00
February	15.90	15.03	14.50	13.28	14.81	14.01
March	15.90	14.95	14.65	13.66	14.96	14.10
April	15.90	15.13	14.65	13.90	15.00	14.15
May	15.90	15.14	14.30	13.90	14.72	14.12
June	15.90	15.15	14.06	14.11	14.56	14.22
July	15.90	15.15	14.03	14.38	14.53	14.38
August	15.90	15.43	14.00	14.90	14.47	14.85
September	15.90	16.86	13.57	16.03	14.40	15.63
October	15.43	17.90	13.44	17.18	14.34	17.22
November	14.92	.....	13.30	.....	14.25	.....
December	15.15	.....	13.10	.....	13.90	.....
Year	$15.72	.....	$13.94	.....	$14.49	.....

STOCK QUOTATIONS

COLO. SPRINGS Nov. 19

Name of Comp.	Bid.
Acacia	.04
Cripple Cr'k Con.	.01½
C. K. & N.	.16½
Doctor Jack Pot	.06
Elkton Con.	.64½
El Paso	5.77
Findlay	.04½
Gold Dollar	.19½
Gold Sovereign	.02½
Isabella	.21½
Jack Pot	.05½
Jennie Sample	.06½
Lexington	.006
Moon Anchor	.01
Old Gold	.03½
Mary McKinney	.78
Pharmacist	.01½
Portland	1.04
Vindicator	.88
Work	.01

SALT LAKE Nov. 19

Name of Comp.	Bid.
Beck Tunnel	.08
Black Jack	.09
Cedar Talisman	.005
Colorado Mining	.17½
Columbus Con.	.12
Crown Point	.02½
Daly-Judge	‡6.00
Grand Central	.78
Iron Blossom	1.27½
Little Bell	‡.75
Lower Mammoth	.04
Mason Valley	12.00
May Day	.20
Nevada Hills	1.50
New York	‡.005
Prince Con	1.70
Silver King Coal'n	3.12½
Sioux Con.	.03
Uncle Sam	.14
Yankee	‡.12

TORONTO Nov. 19

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	‡7.50	Foley O'Brien	.25
Hudson Bay	60.00	Hollinger	14.50
Temiskaming	.42	Imperial	.02½
Wettlaufer-Lor.	.22	Pearl Lake	.23½
Am. Goldfield	‡.40	Porcu. Gold	.16½
Apex	.01½	Preston E. D.	.02½
Crown Chartered	.02½	Rea	.35
Dobie	‡.25	Standard	.00½
Dome	19.50	Swastika	.08½
Dome Exten.	.09½	West Dome	‡.13

SAN FRANCISCO Nov. 19

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.05	Belmont	8.70
Belcher	.37	Jim Butler	.71
Best & Belcher	.07	MacNamara	.20
Caledonia	.95	Midway	.40
Challenge Con.	.03	Mont.-Tonopah	2.00
Chollar	.05	North Star	.33
Confidence	.40	West End Con.	1.55
Con. Virginia	.33	Atlanta	.17
Crown Point	.52	Booth	.05
Gould & Curry	.02	C.O.D. Con	.07
Hale & Norcross	.11	Comb. Frac	.04
Mexican	1.75	Jumbo Extension	.30
Occidental	.71	Pitts.-Silver Peak	.88
Ophir	.53	Silver Pick	.07
Overman	.50	St. Ives	.30
Potosi	.04	Tramp Con.	.02
Savage	.08	Argonaut	‡2.00
Sierra Nevada	.27	Bunker Hill	‡4.50
Union Con.	.35	Central Eureka	.23
Yellow Jacket	.44	So. Eureka	1.50

N. Y. EXCH. Nov. 19

Name of Comp.	Clg.
Amalgamated	85
Am. Agri. Chem.	56⅛
Am.Sm.&Ref.,com	79⅝
Am. Sm. & Ref., pf.	106⅜
Am. Sm. Sec., pf. B	85
Anaconda	43⅝
Batopilas Min.	1⅜
BethlehemSteelpf	69
Chino	48½
Federal M. & S., pf.	42¼
Goldfield Con.	2¾
GreatNor.,ore,ctf.	45⅜
Guggen. Exp.	55⅛
Homestake	98
Inspiration Con.	19⅛
Miami Copper	28¼
Nat'nalLead,com.	59¼
National Lead, pf.	110½
Nev. Consol.	22⅝
Phelps Dodge	215¼
Pittsburg Coal, pf.	91⅞
Ray Con.	22
RepublicI&S,com.	28
Republic I & S, pf.	90
SlossSheffi'd,com.	50
Sloss Sheffield, pf.	95½
Tennessee Copper	40⅝
Utah Copper	63⅞
U. S. Steel, com	74⅝
U. S. Steel, pf.	111⅞
Va. Car. Chem.	46¾

N. Y. CURB Nov. 19

Name of Comp.	Clg.
Barnes King	‡.60
Beaver Con	.42
Braden Copper	9
B. C. Copper	4⅝
Buffalo Mines	.2¼
Caledonia	.40
Con. Ariz. Sm.	7/16
Davis-Daly	2⅛
Diam'field-Daisy	6
Ely Con.	.18
Florence	.74
Giroux	4⅛
Gold Hill Con.	5/16
Greene Cananea	9⅞
Greenwater	.05
Internat. S. & R.	‡124
Kerr Lake	2¾
Keystone	2
La Rose	2⅜
McKinley-Dar-Sa.	2¼
Min. Co. of A. new	2⅞
Motherlode Gold.	.60
Nev. Utah M. & S.	05
Nipissing Mines	8¾
Ohio Copper	1 1/16
Pacific Sm. & M.	1/16
Puebla S. & R.	1 1/16
South Live Oak	2
South Utah M. & S.	⅜
Standard Oil (Old)	1110
Stand'd Oil of N.J.	395
Stewart	1⅜
Tonopah	6½
Tonopah Ex	2¾
Tonopah Merger	.95
Tri-Bullion	11/16
Tularosa	1 1/16
Union Mines	‡.10
United Cop., pfd.	10
Yukon Gold	3 1/16

LONDON Nov. 20

Name of Com	Clg.
Camp Bird	£1 4s 3d
Dolores	1 10 0
El Oro	0 17 3
Esperanza	2 0 6
Mexico Mines	6 17 6
Oroville	0 5 0
Stratton'sInd.	0 3 1½
Tomboy	1 8 9

BOSTON EXCH. Nov. 19

Name of Comp.	Clg.
Adventure	6
Ahmeek	‡330
Algomah	3¼
Allouez	41
Am. Zinc	30¾
Ariz. Com., ctfs.	4
Bonanza	.30
Boston & Corbin	6
Butte & Balak	4 1/16
Calumet & Ariz	78 1/16
Calumet & Hecla	585
Centennial	19½
Cliff	13
Copper Range	56¾
Daly West	3½
East Butte	15
Franklin	10
Granby	75½
Hancock	25
Hedley Gold	25½
Helvetia	.75
Indiana	17½
Island Cr'k, com.	‡55
Island Cr'k, pfd.	86¾
Isle Royale	35½
Keweenaw	2 1/16
Lake	30¾
La Salle	6¾
Mass	6¼
Michigan	1¾
Mohawk	64
New Arcadian	‡21½
New Idria Quick.	5⅛
North Butte	36
North Lake	3
Ojibway	3
Old Dominion	59
Osceola	111
Quincy	89
Shannon	14¾
Shattuck-Ariz.	32¼
Superior	43½
Superior & Bost.	2¾
Tamarack	41
Trinity	5¾
Tuolumne	2⅞
U. S. Smelting	45
U. S. Smelt'g, pf.	51¼
Utah Apex	‡1⅞
Utah Con.	13½
Victoria	2⅛
Winona	4
Wolverine	74
Wyandot	1½

BOSTON CURB Nov. 19

Name of Comp.	Last
Alaska Gold M.	8⅛
Bingham Mines	4⅞
Boston Ely	1
Boswycocolo	.01
Butte Central	8⅛
Cactus	.09
Calaveras	2⅞
Chief Cons	1⅛
Corbin	.26
Cortez	.79
Crown Reserve	3 1/16
First Nat. Cop.	2
Majestic	.43
Mazatan	‡½
Moneta Porc.	.03
Nevada-Douglas	3⅞
New Baltic	1½
Oneco	2
Raven Copper	.21
Portsmouth Coal	‡.03
San Antonio	3½
Smokey Dev.	2 1/16
S. W. Miami	5½
South Lake	6⅞
Trethewey	.32
United Verde Ext.	½

‡Last quotation.